

Appendix M: HAZUS-MH Reports

The HAZUS-MH Reports are organized by jurisdiction in the following order:

- Earthquake
- Flood
- Hurricane

Jurisdiction	Page Number*
Bethany	1
Branford	174
Hamden	364
Madison	538
North Branford	726
North Haven	898
Orange	1055
Wallingford	1228
West Haven	1400
Woodbridge	1567

* The page numbers referenced are on the top right of each page.

Hazus-MH: Earthquake Event Report

Region Name: Bethany_EQ

Earthquake Scenario: Bethany_Annualized_2

Print Date: January 31, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 21.32 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 5,040 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 453 (millions of dollars). Approximately 90.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 239 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 2 thousand buildings in the region which have an aggregate total replacement value of 453 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 2 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 3 dams identified within the region. Of these, 2 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 239.00 (millions of dollars). This inventory includes over 38 kilometers of highways, 2 bridges, 260 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	2	4.40
	Segments	5	235.30
	Tunnels	0	0.00
	Subtotal		239.60
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			239.60

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	2.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.60
Waste Water	Distribution Lines	NA	1.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.60
Natural Gas	Distribution Lines	NA	1.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.00
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			5.20

Earthquake Scenario

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

Scenario Name	Bethany_Annualized_2
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	13	0.67	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	78	4.04	0	0.00	0	0.00	0	0.00	0	0.00
Education	1	0.05	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
Industrial	23	1.19	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	112	5.80	0	0.00	0	0.00	0	0.00	0	0.00
Religion	2	0.10	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	1,701	88.13	0	0.00	0	0.00	0	0.00	0	0.00
Total	1,930		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1,717	88.96	0	0.00	0	0.00	0	0.00	0	0.00
Steel	49	2.54	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	2	0.10	0	0.00	0	0.00	0	0.00	0	0.00
Precast	1	0.05	0	0.00	0	0.00	0	0.00	0	0.00
RM	7	0.36	0	0.00	0	0.00	0	0.00	0	0.00
URM	113	5.85	0	0.00	0	0.00	0	0.00	0	0.00
MH	41	2.12	0	0.00	0	0.00	0	0.00	0	0.00
Total	1,930		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	2	0	0	2
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	5	0	0	5	5
	Bridges	2	0	0	2	2
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	130	0	0
Waste Water	78	0	0
Natural Gas	52	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,755	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 88 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	235.27	\$0.00	0.00
	Bridges	4.37	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	239.60	0.00	
Railways	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	239.60	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.60	\$0.00	0.00
	Subtotal	2.60	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.60	\$0.00	0.00
	Subtotal	1.56	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.00	\$0.00	0.00
	Subtotal	1.04	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	5.20	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	5,040	354	99	453
Total State		5,040	354	99	453
Total Region		5,040	354	99	453

Hazus-MH: Earthquake Event Report

Region Name: Bethany_EQ

Earthquake Scenario: 100_Year_Return_Period_MM_7_Probabilisti

Print Date: January 14, 2013

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

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Building and Lifeline Inventory

Building Inventory

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Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

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	Subtotal		239.60
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			239.60

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	2.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.60
Waste Water	Distribution Lines	NA	1.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.60
Natural Gas	Distribution Lines	NA	1.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.00
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			5.20

Earthquake Scenario

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

Scenario Name	100_Year_Return_Period_MM_7_Probabilisti
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20	0.98	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	131	6.42	0	0.00	0	0.00	0	0.00	0	0.00
Education	6	0.29	0	0.00	0	0.00	0	0.00	0	0.00
Government	3	0.15	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	45	2.20	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	126	6.17	0	0.00	0	0.00	0	0.00	0	0.00
Religion	7	0.34	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	1,703	83.44	0	0.00	0	0.00	0	0.00	0	0.00
Total	2,041		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1,731	84.83	0	0.00	0	0.00	0	0.00	0	0.00
Steel	94	4.62	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	15	0.76	0	0.00	0	0.00	0	0.00	0	0.00
Precast	6	0.29	0	0.00	0	0.00	0	0.00	0	0.00
RM	24	1.16	0	0.00	0	0.00	0	0.00	0	0.00
URM	128	6.29	0	0.00	0	0.00	0	0.00	0	0.00
MH	42	2.06	0	0.00	0	0.00	0	0.00	0	0.00
Total	2,041		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	2	0	0	2
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	5	0	0	5	5
	Bridges	2	0	0	2	2
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	130	0	0
Waste Water	78	0	0
Natural Gas	52	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,755	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	235.27	\$0.00	0.00
	Bridges	4.37	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	239.60	0.00	
Railways	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	239.60	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.60	\$0.00	0.00
	Subtotal	2.60	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.60	\$0.00	0.00
	Subtotal	1.56	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.00	\$0.00	0.00
	Subtotal	1.04	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	5.20	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	5,040	354	99	453
Total State		5,040	354	99	453
Total Region		5,040	354	99	453

Hazus-MH: Flood Event Report

Region Name: Bethany_Flood

Flood Scenario: 100 year A Zone

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 21 square miles and contains 84 census blocks. The region contains over 2 thousand households and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,041 buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 89.61% of the buildings (and 78.19% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 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	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religion	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	141,796	84.3%
Commercial	18,138	10.8%
Industrial	3,936	2.3%
Agricultural	2,377	1.4%
Religion	391	0.2%
Government	1,364	0.8%
Education	122	0.1%
Total	168,124	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire station, 1 police station 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:	Bethany_Flood
Scenario Name:	100 year A Zone
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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.

The model estimates that a total of 97 tons of debris will be generated. Of the total amount, Finishes comprises 53% of the total, Structure comprises 27% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 4 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 21 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 7 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 1.53 million dollars, which represents 0.91 % 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 1.53 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 80.37% 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	0.83	0.05	0.01	0.01	0.90
	Content	0.40	0.15	0.02	0.06	0.63
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	1.23	0.20	0.03	0.07	1.53
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
ALL	Total	1.23	0.20	0.03	0.07	1.53

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Total Study Region	5,040	354,903	99,012	453,915

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany_Flood
 Scenario: 100 year A Zone
 Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany_Flood
 Scenario: 100 year A Zone
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	901	630	1	0.50	0	0	1	0	1,533
Total	901	630	1	0.50	0	0	1	0	1,533
Scenario Total	901	630	1	0.50	0	0	1	0	1,533

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany_Flood
 Scenario: 100 year A Zone
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
ALFALFA HAY	0.00	13,670.64	13,670.64	13,670.64	13,670.64
CORN SILAGE	0.00	40,774.26	54,365.68	54,365.68	54,365.68
Total	0.00	54,444.90	68,036.32	68,036.32	68,036.32
Total	0.00	54,444.90	68,036.32	68,036.32	68,036.32
Scenario Total	0.00	54,444.90	68,036.32	68,036.32	68,036.32

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany_Flood
Scenario: 100 year A Zone
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	901	630	1	0.5	0	0	1	0	1,533
Total	901	630	1	0.5	0	0	1	0	1,533
Scenario Total	901	630	1	0.5	0	0	1	0	1,533

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany_Flood
 Scenario: 100 year A Zone
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Bethany 500yr Riverine

Flood Scenario: 500 year

Print Date: Wednesday, January 30, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 21 square miles and contains 84 census blocks. The region contains over 2 thousand households and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 2,041 buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 89.61% of the buildings (and 78.19% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 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	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religion	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	58,149	85.3%
Commercial	8,477	12.4%
Industrial	1,056	1.5%
Agricultural	478	0.7%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	68,160	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire station, 1 police station 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:	Bethany 500yr Riverine
Scenario Name:	500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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.

The model estimates that a total of 9 tons of debris will be generated. Of the total amount, Finishes comprises 88% of the total, Structure comprises 7% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 14 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 11 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.21 million dollars, which represents 0.30 % 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 0.21 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 61.35% 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	0.08	0.01	0.01	0.00	0.11
	Content	0.04	0.05	0.01	0.00	0.10
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.13	0.07	0.01	0.00	0.21
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>ALL</u>	Total	0.13	0.07	0.01	0.00	0.21

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Total Study Region	5,040	354,903	99,012	453,915

Direct Economic Loss For Agriculture Products

January 30, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
ALFALFA HAY	0.00	62.05	62.05	62.05	62.05
CORN SILAGE	0.00	39,554.91	52,739.88	52,739.88	52,739.88
Total	0.00	39,616.96	52,801.93	52,801.93	52,801.93
Total	0.00	39,616.96	52,801.93	52,801.93	52,801.93
Scenario Total	0.00	39,616.96	52,801.93	52,801.93	52,801.93

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany 500yr Riverine
Scenario: 500 year
Return Period: 500

Direct Economic Annualized Losses for Buildings

January 30, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	105	102	0	0.2	0	0	0	0	207
Total	105	102	0	0.2	0	0	0	0	207
Scenario Total	105	102	0	0.2	0	0	0	0	207

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Bethany 500yr Riverine
 Scenario: 500 year
 Return Period: 500

February 1, 2013

Study Region : Bethany 1938
 Scenario : UN-NAMED-1938-4
 Scenario Description : Historic
 Peak Gust Wind Speed (mph) : 108

Regional Statistics

Area (Square Miles) 21
 Number of Census Tracts 1
 Number of People in the Region 5,040

General Building Stock

<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ M)</i>
Residential	1,829	355
Commercial	131	63
Other	81	36
Total	2,041	454

Scenario Results**Number of Buildings Damaged**

<i>Damage State</i>	<i>Residential</i>	<i>Commercial</i>	<i>Other</i>	<i>Total</i>
Minor	400	20	10	400
Moderate	60	<10	<10	70
Severe	<10	0	0	<10
Destruction	<10	0	0	<10
Total	400	30	20	500

Shelter Requirements

Displaced Households (# Households) 0
 Short Term Shelter (# People) 0

Economic Loss (\$ Millions)

Capital Stock 9

Residential Property	9
Commercial Property	<1
Other Property	<1
Business Interruption (Income)	<1
Total Direct Economic Loss	10

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

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Bethany 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	108 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 74 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	15	75.35	3	17.15	1	4.86	0	2.35	0	0.30
Commercial	106	80.63	19	14.77	5	4.03	1	0.57	0	0.00
Education	5	81.49	1	14.72	0	3.55	0	0.25	0	0.00
Government	2	80.55	0	15.17	0	4.00	0	0.27	0	0.00
Industrial	37	81.35	6	14.05	2	3.79	0	0.75	0	0.07
Religion	6	81.49	1	15.66	0	2.70	0	0.15	0	0.00
Residential	1,383	75.64	381	20.85	58	3.19	4	0.20	2	0.12
Total	1,554		413		67		5		2	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	8	83.24	1	13.46	0	3.15	0	0.15	0	0.00
Masonry	79	77.77	17	16.83	5	4.50	1	0.78	0	0.11
MH	33	97.42	1	1.77	0	0.71	0	0.02	0	0.08
Steel	72	82.33	11	12.92	3	3.99	1	0.76	0	0.01
Wood	1,287	75.41	361	21.14	54	3.14	3	0.20	2	0.11

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 22,628 tons of debris will be generated. Of the total amount, 18,871 tons (83%) is Other Tree Debris. Of the remaining 3,757 tons, Brick/Wood comprises 25% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 37 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,820 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 10.3 million dollars, which represents 2.28 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 10 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 87% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	6,614.42	445.48	154.27	128.84	7,343.02
	Content	1,887.92	100.59	80.55	39.67	2,108.74
	Inventory	0.00	2.89	13.98	2.65	19.52
	Subtotal	8,502.35	548.97	248.80	171.16	9,471.28
<u>Business Interruption Loss</u>						
	Income	0.00	61.09	2.31	10.16	73.57
	Relocation	356.75	86.83	11.35	25.32	480.25
	Rental	109.00	51.77	1.69	2.19	164.65
	Wage	0.00	59.28	3.98	83.22	146.48
	Subtotal	465.76	258.97	19.33	120.90	864.95
<u>Total</u>						
	Total	8,968.10	807.93	268.13	292.06	10,336.23

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	937	0	2,820	18,871	22,628
Total	937	0	2,820	18,871	22,628
Study Region Total	937	0	2,820	18,871	22,628

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

81

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,343	2,109	20	1.62	480	74	146	165	10,336
Total	7,343	2,109	20	1.62	480	74	146	165	10,336
Study Region Total	7,343	2,109	20	1.62	480	74	146	165	10,336

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 366 buildings will be at least moderately damaged. This is over 18% of the total number of buildings in the region. There are an estimated 32 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	8	42.31	6	31.67	3	16.29	2	8.14	0	1.59
Commercial	62	47.61	36	27.45	26	19.76	7	5.12	0	0.06
Education	3	48.74	2	27.43	1	19.54	0	4.29	0	0.00
Government	1	48.96	1	26.47	1	20.06	0	4.52	0	0.00
Industrial	21	47.69	11	25.47	9	20.06	3	6.32	0	0.46
Religion	3	48.07	2	31.42	1	17.13	0	3.38	0	0.00
Residential	835	45.63	682	37.30	233	12.72	48	2.61	32	1.74
Total	935		741		274		60		32	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	10	49.23	5	25.18	4	20.78	1	4.81	0	0.00
Masonry	69	45.96	42	28.01	30	19.68	8	5.38	1	0.97
MH	36	86.90	2	6.01	2	5.21	0	0.52	1	1.36
Steel	46	49.11	22	23.58	19	20.54	6	6.68	0	0.09
Wood	781	45.08	660	38.13	219	12.63	44	2.52	28	1.64

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 65,666 tons of debris will be generated. Of the total amount, 54,011 tons (82%) is Other Tree Debris. Of the remaining 11,655 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 143 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 8,071 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 51 households to be displaced due to the hurricane. Of these, 9 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 45.6 million dollars, which represents 10.05 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 46 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	25,593.53	2,068.17	784.38	549.17	28,995.26
	Content	10,244.80	824.82	504.47	233.28	11,807.37
	Inventory	0.00	22.34	80.99	12.43	115.76
	Subtotal	35,838.33	2,915.32	1,369.84	794.89	40,918.38
<u>Business Interruption Loss</u>						
	Income	0.22	105.26	9.37	12.54	127.40
	Relocation	2,652.74	433.74	68.97	113.91	3,269.36
	Rental	800.04	247.67	8.36	10.35	1,066.41
	Wage	0.52	110.06	15.76	111.86	238.21
	Subtotal	3,453.53	896.74	102.46	248.66	4,701.38
<u>Total</u>						
	Total	39,291.86	3,812.06	1,472.30	1,043.55	45,619.76

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 150 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	13	63.49	5	23.71	2	8.27	1	3.95	0	0.58
Commercial	91	69.46	27	20.94	11	8.25	2	1.33	0	0.01
Education	4	71.08	1	20.91	0	7.39	0	0.62	0	0.00
Government	2	71.41	1	20.36	0	7.58	0	0.65	0	0.00
Industrial	31	69.81	9	19.89	4	8.32	1	1.82	0	0.16
Religion	5	69.62	2	23.19	0	6.67	0	0.52	0	0.00
Residential	1,180	64.52	520	28.41	111	6.06	12	0.64	7	0.37
Total	1,327		564		128		15		7	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	15	71.77	4	19.69	2	7.86	0	0.68	0	0.00
Masonry	101	66.64	34	22.30	14	9.08	3	1.70	0	0.28
MH	39	94.25	1	3.44	1	1.93	0	0.09	0	0.29
Steel	67	71.36	17	18.45	8	8.38	2	1.79	0	0.02
Wood	1,111	64.17	500	28.89	103	5.97	11	0.61	6	0.36

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 38,435 tons of debris will be generated. Of the total amount, 32,051 tons (83%) is Other Tree Debris. Of the remaining 6,384 tons, Brick/Wood comprises 25% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 64 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,789 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 13 households to be displaced due to the hurricane. Of these, 2 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 18.1 million dollars, which represents 4.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 18 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	10,962.71	814.98	302.71	222.13	12,302.53
	Content	3,529.85	234.95	172.85	76.08	4,013.73
	Inventory	0.00	6.83	28.82	5.27	40.92
	Subtotal	14,492.55	1,056.76	504.38	303.48	16,357.19
<u>Business Interruption Loss</u>						
	Income	0.00	76.35	4.12	12.57	93.04
	Relocation	870.67	165.55	25.42	44.92	1,106.56
	Rental	262.33	94.17	3.33	3.83	363.66
	Wage	0.00	79.07	7.08	130.36	216.51
	Subtotal	1,133.00	415.14	39.96	191.67	1,779.77
<u>Total</u>						
	Total	15,625.56	1,471.90	544.34	495.15	18,136.95

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 30 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	17	85.58	2	10.78	0	2.39	0	1.15	0	0.10
Commercial	117	89.38	11	8.76	2	1.62	0	0.24	0	0.00
Education	5	90.57	1	8.48	0	0.91	0	0.04	0	0.00
Government	3	90.79	0	8.26	0	0.92	0	0.03	0	0.00
Industrial	40	89.69	4	8.45	1	1.45	0	0.37	0	0.03
Religion	6	89.67	1	9.41	0	0.87	0	0.05	0	0.00
Residential	1,557	85.12	246	13.45	25	1.37	1	0.03	1	0.03
Total	1,746		265		29		1		1	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	19	91.02	2	8.01	0	0.94	0	0.03	0	0.00
Masonry	131	87.05	16	10.43	3	2.11	1	0.38	0	0.03
MH	41	98.91	0	0.82	0	0.25	0	0.00	0	0.02
Steel	85	90.68	7	7.52	1	1.48	0	0.32	0	0.00
Wood	1,472	85.01	235	13.59	23	1.34	1	0.04	0	0.02

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 12,807 tons of debris will be generated. Of the total amount, 10,684 tons (83%) is Other Tree Debris. Of the remaining 2,123 tons, Brick/Wood comprises 25% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 21 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,596 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 5.1 million dollars, which represents 1.13 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 5 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 87% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	3,668.40	232.08	71.51	57.82	4,029.81
	Content	654.05	43.94	31.70	13.93	743.62
	Inventory	0.00	1.20	5.62	1.19	8.00
	Subtotal	4,322.45	277.22	108.84	72.93	4,781.43
<u>Business Interruption Loss</u>						
	Income	0.00	36.38	1.07	5.50	42.95
	Relocation	117.62	40.41	4.56	10.52	173.11
	Rental	38.88	24.97	0.83	0.80	65.48
	Wage	0.00	32.42	1.83	33.97	68.22
	Subtotal	156.50	134.17	8.30	50.79	349.76
<u>Total</u>						
	Total	4,478.95	411.39	117.13	123.73	5,131.19

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 5 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	19	95.53	1	3.69	0	0.56	0	0.22	0	0.00
Commercial	127	96.65	4	2.96	0	0.36	0	0.03	0	0.00
Education	6	97.08	0	2.83	0	0.09	0	0.00	0	0.00
Government	3	97.12	0	2.80	0	0.08	0	0.00	0	0.00
Industrial	44	96.73	1	2.98	0	0.23	0	0.06	0	0.00
Religion	7	96.99	0	2.91	0	0.09	0	0.01	0	0.00
Residential	1,742	95.26	83	4.53	4	0.21	0	0.00	0	0.00
Total	1,947		89		5		0		0	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	20	97.14	1	2.79	0	0.07	0	0.00	0	0.00
Masonry	144	95.61	6	3.86	1	0.45	0	0.07	0	0.00
MH	41	99.89	0	0.09	0	0.02	0	0.00	0	0.00
Steel	91	97.05	2	2.62	0	0.30	0	0.04	0	0.00
Wood	1,650	95.26	79	4.53	3	0.20	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 9,056 tons of debris will be generated. Of the total amount, 7,716 tons (85%) is Other Tree Debris. Of the remaining 1,340 tons, Brick/Wood comprises 14% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 7 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,153 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 1.9 million dollars, which represents 0.43 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 2 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 92% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	1,614.78	76.86	17.94	15.80	1,725.38
	Content	108.65	8.98	3.81	1.88	123.32
	Inventory	0.00	0.19	0.71	0.19	1.09
	Subtotal	1,723.42	86.03	22.46	17.87	1,849.79
<u>Business Interruption Loss</u>						
	Income	0.00	8.36	0.13	1.15	9.65
	Relocation	47.50	6.74	0.63	0.95	55.81
	Rental	18.35	3.89	0.14	0.07	22.45
	Wage	0.00	2.97	0.22	2.71	5.90
	Subtotal	65.85	21.95	1.12	4.88	93.80
<u>Total</u>						
	Total	1,789.27	107.99	23.58	22.75	1,943.59

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

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Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20	99.23	0	0.72	0	0.04	0	0.01	0	0.00
Commercial	130	99.18	1	0.78	0	0.04	0	0.00	0	0.00
Education	6	99.22	0	0.77	0	0.01	0	0.00	0	0.00
Government	3	99.19	0	0.80	0	0.01	0	0.00	0	0.00
Industrial	45	99.16	0	0.83	0	0.02	0	0.00	0	0.00
Religion	7	99.35	0	0.63	0	0.02	0	0.00	0	0.00
Residential	1,819	99.46	10	0.53	0	0.01	0	0.00	0	0.00
Total	2,029		11		0		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	21	99.15	0	0.85	0	0.00	0	0.00	0	0.00
Masonry	150	99.03	1	0.92	0	0.05	0	0.00	0	0.00
MH	41	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	93	99.18	1	0.79	0	0.03	0	0.00	0	0.00
Wood	1,723	99.47	9	0.52	0	0.01	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 729 tons of debris will be generated. Of the total amount, 593 tons (81%) is Other Tree Debris. Of the remaining 136 tons, Brick/Wood comprises 35% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 89 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.6 million dollars, which represents 0.13 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 96% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	532.80	17.66	4.11	3.47	558.05
	Content	18.07	0.00	0.00	0.00	18.07
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	550.88	17.66	4.11	3.47	576.13
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	1.57	0.21	0.02	0.03	1.83
	Rental	1.16	0.00	0.00	0.00	1.16
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	2.73	0.21	0.02	0.03	2.99
<u>Total</u>						
	Total	553.61	17.87	4.13	3.50	579.11

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20	99.83	0	0.17	0	0.00	0	0.00	0	0.00
Commercial	131	99.78	0	0.22	0	0.00	0	0.00	0	0.00
Education	6	99.77	0	0.23	0	0.00	0	0.00	0	0.00
Government	3	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Industrial	45	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Religion	7	99.81	0	0.19	0	0.00	0	0.00	0	0.00
Residential	1,829	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	2,040		1		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	21	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Masonry	151	99.79	0	0.21	0	0.00	0	0.00	0	0.00
MH	41	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	94	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Wood	1,732	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.86	0.00	0.00	0.00	0.86
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.86	0.00	0.00	0.00	0.86
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.01	0.00	0.00	0.00	0.01
<u>Total</u>						
	Total	0.86	0.00	0.00	0.00	0.86

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Hazus-MH: Hurricane Event Report

Region Name: Bethany Probabilistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.33 square miles and contains 1 census tracts. There are over 1 thousand households in the region and has a total population of 5,040 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 454 million dollars (2006 dollars). Approximately 90% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 2,041 buildings in the region which have an aggregate total replacement value of 454 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	354,903	78.2%
Commercial	62,833	13.8%
Industrial	20,551	4.5%
Agricultural	3,820	0.8%
Religious	3,489	0.8%
Government	3,532	0.8%
Education	4,787	1.1%
Total	453,915	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	131	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	6	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	3	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	45	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	7	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	1,829	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	2,041		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	21	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	151	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	41	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	94	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	1,732	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 5,040) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	5,040	354,903	99,012	453,915
Total	5,040	354,903	99,012	453,915
Study Region Total	5,040	354,903	99,012	453,915

Debris Summary Report: 10 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 50 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	47	0	89	593	729
Total	47	0	89	593	729
Study Region Total	47	0	89	593	729

Debris Summary Report: 100 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	187	0	1,153	7,716	9,056
Total	187	0	1,153	7,716	9,056
Study Region Total	187	0	1,153	7,716	9,056

Debris Summary Report: 200 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	526	1	1,596	10,684	12,807
Total	526	1	1,596	10,684	12,807
Study Region Total	526	1	1,596	10,684	12,807

Debris Summary Report: 500 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1,585	10	4,789	32,051	38,435
Total	1,585	10	4,789	32,051	38,435
Study Region Total	1,585	10	4,789	32,051	38,435

Debris Summary Report: 1000 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	3,547	37	8,071	54,011	65,666
Total	3,547	37	8,071	54,011	65,666
Study Region Total	3,547	37	8,071	54,011	65,666

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

166

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	130	43	0	0.03	11	1	2	4	191
Total	130	43	0	0.03	11	1	2	4	191
Study Region Total	130	43	0	0.03	11	1	2	4	191

Direct Economic Losses For Buildings: 10 - year Event

167

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

168

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1	0	0	0.00	0	0	0	0	1
Total	1	0	0	0.00	0	0	0	0	1
Study Region Total	1	0	0	0.00	0	0	0	0	1

Direct Economic Losses For Buildings: 50 - year Event

169

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	558	18	0	0.12	2	0	0	1	579
Total	558	18	0	0.12	2	0	0	1	579
Study Region Total	558	18	0	0.12	2	0	0	1	579

Direct Economic Losses For Buildings: 100 - year Event

170

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,725	123	1	0.38	56	10	6	22	1,944
Total	1,725	123	1	0.38	56	10	6	22	1,944
Study Region Total	1,725	123	1	0.38	56	10	6	22	1,944

Direct Economic Losses For Buildings: 200 - year Event

171

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	4,030	744	8	0.89	173	43	68	65	5,131
Total	4,030	744	8	0.89	173	43	68	65	5,131
Study Region Total	4,030	744	8	0.89	173	43	68	65	5,131

Direct Economic Losses For Buildings: 500 - year Event

172

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	12,303	4,014	41	2.71	1,107	93	217	364	18,137
Total	12,303	4,014	41	2.71	1,107	93	217	364	18,137
Study Region Total	12,303	4,014	41	2.71	1,107	93	217	364	18,137

Direct Economic Losses For Buildings: 1000 - year Event

173

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	28,995	11,807	116	6.39	3,269	127	238	1,066	45,620
Total	28,995	11,807	116	6.39	3,269	127	238	1,066	45,620
Study Region Total	28,995	11,807	116	6.39	3,269	127	238	1,066	45,620

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Bethany Probabilistic-Annualized
Scenario : Probabilistic

Hazus-MH: Earthquake Event Report

Region Name: Branford_CT

Earthquake Scenario: Branford_Annualized_Probablistic

Print Date: January 14, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 22.54 square miles and contains 7 census tracts. There are over 12 thousand households in the region which has a total population of 28,683 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,996 (millions of dollars). Approximately 90.00 % of the buildings (and 71.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 503 and 203 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 11 thousand buildings in the region which have an aggregate total replacement value of 2,996 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 82% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 706.00 (millions of dollars). This inventory includes over 27 kilometers of highways, 28 bridges, 549 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	28	245.40
	Segments	10	184.90
	Tunnels	0	0.00
	Subtotal		430.30
Railways	Bridges	3	0.20
	Facilities	0	0.00
	Segments	7	25.10
	Tunnels	0	0.00
	Subtotal		25.30
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	4	44.90
	Tunnels	0	0.00
	Subtotal		47.60
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			503.20

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.50
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.50
Waste Water	Distribution Lines	NA	3.30
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.90
Natural Gas	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	1	126.50
	Subtotal		126.50
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			214.10

Earthquake Scenario

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

Scenario Name	Branford_Annualized_Probablistic
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	17	0.15	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	413	3.76	0	0.00	0	0.00	0	0.00	0	0.00
Education	4	0.04	0	0.00	0	0.00	0	0.00	0	0.00
Government	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	112	1.02	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	1,769	16.12	0	0.00	0	0.00	0	0.00	0	0.00
Religion	18	0.16	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	8,642	78.74	0	0.00	0	0.00	0	0.00	0	0.00
Total	10,976		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	9,499	86.54	0	0.00	0	0.00	0	0.00	0	0.00
Steel	270	2.46	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	32	0.29	0	0.00	0	0.00	0	0.00	0	0.00
Precast	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
RM	108	0.98	0	0.00	0	0.00	0	0.00	0	0.00
URM	833	7.59	0	0.00	0	0.00	0	0.00	0	0.00
MH	234	2.13	0	0.00	0	0.00	0	0.00	0	0.00
Total	10,976		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 52 hospital beds available for use. On the day of the earthquake, the model estimates that only 51 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	2	0	0	2
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	10	0	0	10	10
	Bridges	28	0	0	28	28
	Tunnels	0	0	0	0	0
Railways	Segments	7	0	0	7	7
	Bridges	3	0	0	3	3
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	4	0	0	4	4
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	275	0	0
Waste Water	165	0	0
Natural Gas	110	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	12,543	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.01 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.01 (millions of dollars); 17 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 58 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.01
	Total	0.00	0.00	0.00	0.00	0.00	0.01

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	184.87	\$0.00	0.00
	Bridges	245.44	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	430.30	0.00	
Railways	Segments	25.12	\$0.00	0.00
	Bridges	0.17	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	25.30	0.00	
Light Rail	Segments	44.94	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	47.60	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	503.20	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.50	\$0.00	0.00
	Subtotal	5.50	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	79.89	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.20	\$0.00	0.00
	Subtotal	2.20	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	126.50	\$0.00	0.00
	Subtotal	126.50	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	214.09	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	28,683	2,131	864	2,996
Total State		28,683	2,131	864	2,996
Total Region		28,683	2,131	864	2,996

Hazus-MH: Earthquake Event Report

Region Name: Branford_CT

Earthquake Scenario: Branford_100yr_MM_7_Probablistic

Print Date: January 14, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 22.54 square miles and contains 7 census tracts. There are over 12 thousand households in the region which has a total population of 28,683 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,996 (millions of dollars). Approximately 90.00 % of the buildings (and 71.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 503 and 203 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 11 thousand buildings in the region which have an aggregate total replacement value of 2,996 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 82% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 706.00 (millions of dollars). This inventory includes over 27 kilometers of highways, 28 bridges, 549 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	28	245.40
	Segments	10	184.90
	Tunnels	0	0.00
	Subtotal		430.30
Railways	Bridges	3	0.20
	Facilities	0	0.00
	Segments	7	25.10
	Tunnels	0	0.00
	Subtotal		25.30
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	4	44.90
	Tunnels	0	0.00
	Subtotal		47.60
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			503.20

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.50
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.50
Waste Water	Distribution Lines	NA	3.30
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.90
Natural Gas	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	1	126.50
	Subtotal		126.50
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			214.10

Earthquake Scenario

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

Scenario Name	Branford_100yr_MM_7_Probablistic
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	46	0.39	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	741	6.28	0	0.00	0	0.00	0	0.00	0	0.00
Education	28	0.24	0	0.00	0	0.00	0	0.00	0	0.00
Government	12	0.10	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	269	2.28	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	1,995	16.92	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	0.37	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	8,657	73.41	0	0.00	0	0.00	0	0.00	0	0.00
Total	11,792		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	9,612	81.51	0	0.00	0	0.00	0	0.00	0	0.00
Steel	566	4.80	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	139	1.18	0	0.00	0	0.00	0	0.00	0	0.00
Precast	34	0.29	0	0.00	0	0.00	0	0.00	0	0.00
RM	250	2.12	0	0.00	0	0.00	0	0.00	0	0.00
URM	954	8.09	0	0.00	0	0.00	0	0.00	0	0.00
MH	237	2.01	0	0.00	0	0.00	0	0.00	0	0.00
Total	11,792		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 52 hospital beds available for use. On the day of the earthquake, the model estimates that only 51 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	2	0	0	2
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	10	0	0	10	10
	Bridges	28	0	0	28	28
	Tunnels	0	0	0	0	0
Railways	Segments	7	0	0	7	7
	Bridges	3	0	0	3	3
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	4	0	0	4	4
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	275	0	0
Waste Water	165	0	0
Natural Gas	110	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	12,543	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
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	Bridges	245.44	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	430.30	0.00	
Railways	Segments	25.12	\$0.00	0.00
	Bridges	0.17	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	25.30	0.00	
Light Rail	Segments	44.94	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	47.60	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	503.20	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.50	\$0.00	0.00
	Subtotal	5.50	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	79.89	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.20	\$0.00	0.00
	Subtotal	2.20	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	126.50	\$0.00	0.00
	Subtotal	126.50	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	214.09	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	28,683	2,131	864	2,996
Total State		28,683	2,131	864	2,996
Total Region		28,683	2,131	864	2,996

Hazus-MH: Flood Event Report

Region Name: Brandford Coastal 3

Flood Scenario: Coastal Flood

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 22 square miles and contains 440 census blocks. The region contains over 13 thousand households and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 11,792 buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90.33% of the buildings (and 71.14% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 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	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religion	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	426,629	86.6%
Commercial	49,828	10.1%
Industrial	8,825	1.8%
Agricultural	1,358	0.3%
Religion	4,923	1.0%
Government	140	0.0%
Education	854	0.2%
Total	492,557	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire station, 2 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:	Brandford Coastal 3
Scenario Name:	Coastal Flood
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 29 buildings will be at least moderately damaged. This is over 32% of the total number of buildings in the scenario. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	4	13.79	12	41.38	3	10.34	9	31.03	1	3.45
Total	0		4		12		3		9		1	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	4	13.79	12	41.38	3	10.34	9	31.03	1	3.45

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 52 hospital beds available for use. On the day of the scenario flood event, the model estimates that 52 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	1	0	0	0
Hospitals	1	0	0	0
Police Stations	2	0	0	0
Schools	9	0	0	0

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.

The model estimates that a total of 2,471 tons of debris will be generated. Of the total amount, Finishes comprises 36% of the total, Structure comprises 39% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 99 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 136 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 192 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 14.08 million dollars, which represents 2.86 % 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 14.07 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 78.79% 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	6.84	0.72	0.09	0.02	7.66
	Content	4.25	1.76	0.21	0.16	6.37
	Inventory	0.00	0.02	0.01	0.00	0.03
	Subtotal	11.09	2.49	0.31	0.18	14.07
<u>Business Interruption</u>						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.00	0.01
	Subtotal	0.01	0.01	0.00	0.00	0.02
ALL	Total	11.09	2.50	0.31	0.18	14.08

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Total Study Region	28,683	2,131,709	864,998	2,996,707

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Brandford Coastal 3
 Scenario: Coastal Flood
 Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Brandford Coastal 3
 Scenario: Coastal Flood
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,664	6,371	30	1.60	5	5	5	0	14,080
Total	7,664	6,371	30	1.60	5	5	5	0	14,080
Scenario Total	7,664	6,371	30	1.60	5	5	5	0	14,080

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Brandford Coastal 3
 Scenario: Coastal Flood
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Total					
Total					
Scenario Total					

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,664	6,371	30	1.6	5	5	5	0	14,080
Total	7,664	6,371	30	1.6	5	5	5	0	14,080
Scenario Total	7,664	6,371	30	1.6	5	5	5	0	14,080

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Brandford Coastal 3
 Scenario: Coastal Flood
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Branford Riverine

Flood Scenario: Riverin Analysis

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 22 square miles and contains 440 census blocks. The region contains over 13 thousand households and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 11,792 buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90.33% of the buildings (and 71.14% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 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	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religion	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,137,270	71.1%
Commercial	314,530	19.7%
Industrial	101,810	6.4%
Agricultural	6,039	0.4%
Religion	23,911	1.5%
Government	1,794	0.1%
Education	14,710	0.9%
Total	1,600,064	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire station, 2 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:	Branford Riverine
Scenario Name:	Riverin Analysis
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 366 buildings will be at least moderately damaged. This is over 40% of the total number of buildings in the scenario. There are an estimated 52 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	24	6.56	88	24.04	98	26.78	104	28.42	52	14.21
Total	0		24		88		98		104		52	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	100.00
Masonry	0	0.00	0	0.00	2	22.22	3	33.33	3	33.33	1	11.11
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	24	6.82	86	24.43	95	26.99	99	28.13	48	13.64

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 52 hospital beds available for use. On the day of the scenario flood event, the model estimates that 52 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	1	0	0	0
Hospitals	1	0	0	0
Police Stations	2	0	0	0
Schools	9	1	0	1

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.

The model estimates that a total of 11,941 tons of debris will be generated. Of the total amount, Finishes comprises 51% of the total, Structure comprises 30% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 478 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 1,324 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 3,295 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 138.65 million dollars, which represents 8.67 % 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 138.15 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 55.04% 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	46.43	10.66	4.03	1.34	62.46
	Content	29.77	28.11	7.94	7.89	73.71
	Inventory	0.00	0.44	1.45	0.09	1.98
	Subtotal	76.20	39.20	13.42	9.32	138.15
<u>Business Interruption</u>						
	Income	0.00	0.15	0.00	0.01	0.16
	Relocation	0.07	0.03	0.00	0.00	0.10
	Rental Income	0.03	0.01	0.00	0.00	0.04
	Wage	0.01	0.13	0.00	0.07	0.20
	Subtotal	0.11	0.32	0.00	0.08	0.51
ALL	Total	76.31	39.52	13.42	9.41	138.65

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Total Study Region	28,683	2,131,709	864,998	2,996,707

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford Riverine
 Scenario: Riverin Analysis
 Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford Riverine
 Scenario: Riverin Analysis
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	62,458	73,705	1,983	3.90	101	163	203	39	138,652
Total	62,458	73,705	1,983	3.90	101	163	203	39	138,652
Scenario Total	62,458	73,705	1,983	3.90	101	163	203	39	138,652

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford Riverine
 Scenario: Riverin Analysis
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	51,923.60	69,231.47	69,231.47	69,231.47
Total	0.00	51,923.60	69,231.47	69,231.47	69,231.47
Total	0.00	51,923.60	69,231.47	69,231.47	69,231.47
Scenario Total	0.00	51,923.60	69,231.47	69,231.47	69,231.47

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford Riverine
Scenario: Riverin Analysis
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	62,458	73,705	1,983	3.9	101	163	203	39	138,652
Total	62,458	73,705	1,983	3.9	101	163	203	39	138,652
Scenario Total	62,458	73,705	1,983	3.9	101	163	203	39	138,652

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford Riverine
 Scenario: Riverin Analysis
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Branford 500 year riverine

Flood Scenario: Branford 500 year

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 22 square miles and contains 440 census blocks. The region contains over 13 thousand households and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 11,792 buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90.33% of the buildings (and 71.14% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 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	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religion	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	534,319	70.9%
Commercial	149,563	19.8%
Industrial	46,845	6.2%
Agricultural	3,080	0.4%
Religion	5,081	0.7%
Government	1,683	0.2%
Education	13,407	1.8%
Total	753,978	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire station, 2 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:	Branford 500 year riverine
Scenario Name:	Branford 500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 7 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	1	14.29	1	14.29	3	42.86	2	28.57	0	0.00
Total	0		1		1		3		2		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	1	14.29	1	14.29	3	42.86	2	28.57	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 52 hospital beds available for use. On the day of the scenario flood event, the model estimates that 52 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	1	0	0	0
Hospitals	1	0	0	0
Police Stations	2	0	0	0
Schools	9	0	0	0

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.

The model estimates that a total of 277 tons of debris will be generated. Of the total amount, Finishes comprises 73% of the total, Structure comprises 16% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 11 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 124 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 173 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 6.59 million dollars, which represents 0.87 % 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 6.59 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 55.84% 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	2.42	0.41	0.26	0.06	3.16
	Content	1.26	1.16	0.54	0.39	3.35
	Inventory	0.00	0.01	0.06	0.01	0.08
	Subtotal	3.68	1.59	0.86	0.46	6.59
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.01
ALL	Total	3.68	1.59	0.86	0.46	6.59

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Total Study Region	28,683	2,131,709	864,998	2,996,707

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	4,722.59	6,296.79	6,296.79	6,296.79
Total	0.00	4,722.59	6,296.79	6,296.79	6,296.79
Total	0.00	4,722.59	6,296.79	6,296.79	6,296.79
Scenario Total	0.00	4,722.59	6,296.79	6,296.79	6,296.79

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford 500 year riverine
Scenario: Branford 500 year
Return Period: 500

Direct Economic Annualized Losses for Buildings

January 31, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut										
	New Haven	3,162	3,346	77	0.4	1	1	3	0	6,590
	Total	3,162	3,346	77	0.4	1	1	3	0	6,590
Scenario Total		3,162	3,346	77	0.4	1	1	3	0	6,590

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Branford 500 year riverine
 Scenario: Branford 500 year
 Return Period: 500

February 1, 2013

Study Region : Branford 1938
 Scenario : UN-NAMED-1938-4
 Scenario Description : Historic
 Peak Gust Wind Speed (mph) : 115

Regional Statistics

Area (Square Miles) 23
 Number of Census Tracts 7
 Number of People in the Region 28,683

General Building Stock

<i>Occupancy</i>	<i>Building Count</i>	<i>Dollar Exposure (\$ M)</i>
Residential	10,652	2,132
Commercial	741	589
Other	399	276
Total	11,792	2,997

Scenario Results**Number of Buildings Damaged**

<i>Damage State</i>	<i>Residential</i>	<i>Commercial</i>	<i>Other</i>	<i>Total</i>
Minor	3,300	200	90	3,600
Moderate	1,100	100	50	1,200
Severe	100	20	20	200
Destruction	90	0	<10	90
Total	4,600	300	200	5,100

Shelter Requirements

Displaced Households (# Households) 100
 Short Term Shelter (# People) 30

Economic Loss (\$ Millions)

Capital Stock	169
Residential Property	137
Commercial Property	18
Other Property	13
Business Interruption (Income)	21
Total Direct Economic Loss	190

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

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Branford 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	115 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,489 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the region. There are an estimated 92 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	26	55.78	12	26.37	5	11.19	3	5.69	0	0.97
Commercial	440	59.42	176	23.69	101	13.57	24	3.30	0	0.03
Education	17	61.32	7	23.37	4	12.84	1	2.47	0	0.00
Government	7	57.12	3	23.49	2	15.79	0	3.60	0	0.00
Industrial	162	60.34	59	21.99	36	13.54	10	3.89	1	0.24
Religion	26	59.01	12	26.64	5	12.05	1	2.29	0	0.00
Residential	6,058	56.87	3,299	30.97	1,077	10.11	127	1.19	91	0.85
Total	6,736		3,567		1,230		167		92	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	49	59.15	18	22.48	13	15.82	2	2.55	0	0.00
Masonry	485	52.42	220	23.82	195	21.12	21	2.31	3	0.32
MH	194	92.79	8	3.90	5	2.52	0	0.15	1	0.65
Steel	295	60.44	101	20.68	71	14.63	21	4.21	0	0.04
Wood	5,481	57.48	3,083	32.33	780	8.18	109	1.14	83	0.87

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	1	0	0
Police Stations	2	0	0	2
Schools	9	1	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 52,563 tons of debris will be generated. Of the total amount, 18,425 tons (35%) is Other Tree Debris. Of the remaining 34,138 tons, Brick/Wood comprises 53% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 731 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 15,857 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 130 households to be displaced due to the hurricane. Of these, 26 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 189.8 million dollars, which represents 6.33 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 190 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 80% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	103,588.87	12,900.90	5,510.42	1,839.81	123,840.00
	Content	33,695.27	5,457.10	4,124.61	753.52	44,030.50
	Inventory	0.00	132.50	680.01	20.97	833.48
	Subtotal	137,284.14	18,490.51	10,315.04	2,614.30	168,703.98
<u>Business Interruption Loss</u>						
	Income	2.38	740.41	71.89	73.45	888.12
	Relocation	9,578.24	2,564.45	436.18	371.64	12,950.51
	Rental	4,526.19	1,431.89	75.73	32.99	6,066.80
	Wage	5.60	798.48	117.57	309.24	1,230.89
	Subtotal	14,112.42	5,535.22	701.37	787.32	21,136.33
<u>Total</u>						
	Total	151,396.55	24,025.73	11,016.41	3,401.62	189,840.31

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	18,177	104	15,857	18,425	52,563
Total	18,177	104	15,857	18,425	52,563
Study Region Total	18,177	104	15,857	18,425	52,563

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

270

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	123,840	44,030	833	4.13	12,951	888	1,231	6,067	189,840
Total	123,840	44,030	833	4.13	12,951	888	1,231	6,067	189,840
Study Region Total	123,840	44,030	833	4.13	12,951	888	1,231	6,067	189,840

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

January 31, 2013

Study Region : Branford Probabilistic-Annualized

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	23
Number of Census Tracts	7
Number of People in the Region	28,683
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	10,652	2,131,709
Commercial	741	589,389
Other	399	275,609
Total	11,792	2,996,707

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	11	1	0	0	12
50	271	25	1	0	297
100	1,167	171	5	3	1,346
200	2,542	623	43	29	3,237
500	3,826	1,697	306	217	6,045
1000	3,916	2,619	796	614	7,946

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	14	1	0	0	15
50	292	27	1	0	320
100	1,252	187	8	3	1,450
200	2,746	704	59	29	3,538
500	4,125	1,924	390	221	6,660
1000	4,207	2,949	1,000	622	8,779

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	3	0
100	38	9
200	144	30
500	626	134
1000	1,675	359

Economic Loss (x 1000)

ReturnPeriod	<u>Property Damage (Capital Stock) Losses</u>		<u>Business Interruption (Income) Losses</u>
	Residential	Total	
10	0	0	0
20	749	828	16
50	9,657	10,215	688
100	28,373	31,405	2,825
200	77,060	91,162	11,040
500	243,822	296,939	38,267
1000	504,468	630,027	85,023
Annualized	2,136	2,600	314

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 4,571 buildings will be at least moderately damaged. This is over 39% of the total number of buildings in the region. There are an estimated 622 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	10	22.69	15	32.32	11	24.86	7	15.72	2	4.40
Commercial	200	27.05	192	25.90	217	29.31	130	17.49	2	0.26
Education	8	27.97	7	25.40	8	29.31	5	17.30	0	0.01
Government	3	26.30	3	23.22	4	30.09	2	20.38	0	0.01
Industrial	74	27.37	61	22.57	77	28.61	53	19.87	4	1.58
Religion	12	26.34	14	30.95	12	28.18	6	14.48	0	0.05
Residential	2,706	25.41	3,916	36.77	2,619	24.59	796	7.48	614	5.76
Total	3,013		4,207		2,949		1,000		622	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	44	25.15	36	20.88	61	35.32	32	18.65	0	0.00
Masonry	285	23.76	285	23.78	440	36.68	163	13.63	26	2.15
MH	187	78.76	17	7.03	20	8.58	3	1.38	10	4.25
Steel	157	27.72	115	20.26	170	29.97	123	21.69	2	0.35
Wood	2,436	25.35	3,797	39.51	2,127	22.13	683	7.11	567	5.90

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	1	0	0
Police Stations	2	2	0	2
Schools	9	9	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 125,840 tons of debris will be generated. Of the total amount, 34,916 tons (28%) is Other Tree Debris. Of the remaining 90,924 tons, Brick/Wood comprises 64% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2375 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 31,553 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,675 households to be displaced due to the hurricane. Of these, 359 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 715.1 million dollars, which represents 23.86 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 715 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 78% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	355,785.79	49,542.63	19,019.79	7,020.75	431,368.97
	Content	148,682.54	27,309.75	15,709.15	3,773.76	195,475.20
	Inventory	0.00	610.03	2,495.77	77.14	3,182.93
	Subtotal	504,468.33	77,462.41	37,224.71	10,871.65	630,027.10
<u>Business Interruption Loss</u>						
	Income	42.57	7,344.94	351.59	121.53	7,860.63
	Relocation	35,664.21	9,077.53	1,326.78	1,333.13	47,401.64
	Rental	14,637.82	5,562.46	249.79	132.69	20,582.76
	Wage	100.34	8,089.34	577.40	411.07	9,178.15
	Subtotal	50,444.94	30,074.26	2,505.56	1,998.42	85,023.18
<u>Total</u>						
	Total	554,913.27	107,536.68	39,730.27	12,870.08	715,050.29

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 2,535 buildings will be at least moderately damaged. This is over 22% of the total number of buildings in the region. There are an estimated 221 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	19	41.53	14	30.98	8	16.59	4	8.97	1	1.93
Commercial	342	46.20	196	26.51	149	20.15	52	7.07	1	0.07
Education	13	47.85	7	26.31	6	19.70	2	6.14	0	0.00
Government	5	44.89	3	25.35	3	21.89	1	7.87	0	0.00
Industrial	125	46.54	64	23.95	54	20.20	23	8.63	2	0.68
Religion	20	45.75	13	30.54	8	18.35	2	5.35	0	0.00
Residential	4,607	43.25	3,826	35.92	1,697	15.93	306	2.87	217	2.04
Total	5,132		4,125		1,924		390		221	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	76	43.47	42	24.03	45	25.70	12	6.80	0	0.00
Masonry	483	40.32	305	25.45	332	27.72	68	5.67	10	0.84
MH	211	88.51	13	5.36	10	4.33	1	0.40	3	1.40
Steel	265	46.80	127	22.35	123	21.69	51	9.05	1	0.11
Wood	4,197	43.68	3,657	38.05	1,290	13.43	264	2.75	202	2.10

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	1	0	0
Police Stations	2	0	0	2
Schools	9	5	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 77,973 tons of debris will be generated. Of the total amount, 25,719 tons (33%) is Other Tree Debris. Of the remaining 52,254 tons, Brick/Wood comprises 57% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1200 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 22,249 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 626 households to be displaced due to the hurricane. Of these, 134 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 335.2 million dollars, which represents 11.19 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 335 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 80% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	177,445.57	21,763.57	8,655.45	3,156.95	211,021.54
	Content	66,376.14	10,128.70	6,618.02	1,435.82	84,558.69
	Inventory	0.00	238.35	1,082.40	38.04	1,358.79
	Subtotal	243,821.71	32,130.63	16,355.87	4,630.81	296,939.01
<u>Business Interruption Loss</u>						
	Income	7.42	1,568.67	124.70	95.08	1,795.87
	Relocation	18,095.13	4,306.74	667.94	630.39	23,700.19
	Rental	7,783.76	2,474.19	115.63	59.21	10,432.78
	Wage	17.48	1,714.84	204.14	401.37	2,337.82
	Subtotal	25,903.78	10,064.43	1,112.41	1,186.05	38,266.67
<u>Total</u>						
	Total	269,725.49	42,195.06	17,468.28	5,816.86	335,205.68

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

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Note:

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There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 792 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 29 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	32	68.94	9	20.40	3	6.87	2	3.33	0	0.46
Commercial	546	73.70	133	17.97	53	7.11	9	1.21	0	0.01
Education	21	74.78	5	18.00	2	6.54	0	0.68	0	0.00
Government	9	73.23	2	18.27	1	7.63	0	0.86	0	0.00
Industrial	198	73.69	45	16.90	20	7.35	5	1.89	0	0.16
Religion	33	73.96	9	19.79	3	5.69	0	0.55	0	0.00
Residential	7,415	69.61	2,542	23.87	623	5.85	43	0.40	29	0.27
Total	8,254		2,746		704		59		29	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	125	72.00	32	18.58	15	8.75	1	0.67	0	0.00
Masonry	797	66.50	233	19.41	153	12.77	14	1.18	2	0.15
MH	229	96.25	6	2.34	3	1.13	0	0.04	1	0.24
Steel	422	74.40	91	16.11	44	7.83	9	1.64	0	0.02
Wood	6,774	70.49	2,362	24.58	411	4.28	37	0.38	27	0.28

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	1	0	0
Police Stations	2	0	0	2
Schools	9	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 30,750 tons of debris will be generated. Of the total amount, 10,533 tons (34%) is Other Tree Debris. Of the remaining 20,217 tons, Brick/Wood comprises 53% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 434 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 9,372 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 144 households to be displaced due to the hurricane. Of these, 30 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 102.2 million dollars, which represents 3.41 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 102 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 82% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	60,098.87	6,159.90	2,609.27	899.28	69,767.32
	Content	16,960.94	2,019.07	1,753.52	295.93	21,029.45
	Inventory	0.00	51.34	302.22	11.30	364.86
	Subtotal	77,059.81	8,230.31	4,665.01	1,206.50	91,161.63
<u>Business Interruption Loss</u>						
	Income	0.00	735.86	35.60	84.83	856.28
	Relocation	4,237.54	1,228.77	199.48	175.70	5,841.49
	Rental	2,395.76	680.76	35.33	15.15	3,126.99
	Wage	0.00	775.82	58.04	381.65	1,215.51
	Subtotal	6,633.30	3,421.20	328.44	657.33	11,040.27
<u>Total</u>						
	Total	83,693.11	11,651.51	4,993.45	1,863.84	102,201.90

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 197 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	41	88.38	4	8.81	1	1.90	0	0.83	0	0.07
Commercial	674	90.92	55	7.46	11	1.45	1	0.17	0	0.00
Education	26	91.86	2	7.19	0	0.92	0	0.03	0	0.00
Government	11	91.03	1	7.79	0	1.15	0	0.03	0	0.00
Industrial	245	91.07	19	7.19	4	1.40	1	0.32	0	0.02
Religion	40	90.96	4	8.09	0	0.91	0	0.04	0	0.00
Residential	9,306	87.37	1,167	10.96	171	1.61	5	0.05	3	0.02
Total	10,342		1,252		187		8		3	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	157	90.07	15	8.44	3	1.47	0	0.02	0	0.00
Masonry	1,020	85.06	123	10.23	54	4.47	3	0.23	0	0.02
MH	237	99.47	1	0.42	0	0.10	0	0.00	0	0.01
Steel	518	91.38	39	6.83	9	1.55	1	0.23	0	0.00
Wood	8,471	88.15	1,044	10.86	89	0.93	4	0.04	3	0.03

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	0	0	0
Police Stations	2	0	0	2
Schools	9	0	0	4

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 13,902 tons of debris will be generated. Of the total amount, 5,053 tons (36%) is Other Tree Debris. Of the remaining 8,849 tons, Brick/Wood comprises 47% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 165 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,720 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 38 households to be displaced due to the hurricane. Of these, 9 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 34.2 million dollars, which represents 1.14 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 34 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 88% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	23,649.09	1,580.35	546.42	231.60	26,007.46
	Content	4,724.19	297.51	269.56	46.97	5,338.23
	Inventory	0.00	7.62	49.20	2.43	59.25
	Subtotal	28,373.28	1,885.48	865.18	281.01	31,404.94
<u>Business Interruption Loss</u>						
	Income	0.00	215.47	4.32	28.63	248.42
	Relocation	955.88	252.71	24.41	33.83	1,266.83
	Rental	806.27	143.85	3.91	3.05	957.09
	Wage	0.00	238.29	7.18	106.91	352.38
	Subtotal	1,762.15	850.33	39.82	172.42	2,824.72
<u>Total</u>						
	Total	30,135.43	2,735.80	905.00	453.42	34,229.66

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 28 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	45	97.63	1	2.05	0	0.24	0	0.07	0	0.00
Commercial	726	97.99	14	1.83	1	0.17	0	0.01	0	0.00
Education	27	98.17	0	1.78	0	0.04	0	0.00	0	0.00
Government	12	98.01	0	1.94	0	0.04	0	0.00	0	0.00
Industrial	264	97.97	5	1.90	0	0.11	0	0.02	0	0.00
Religion	43	98.16	1	1.78	0	0.05	0	0.01	0	0.00
Residential	10,355	97.21	271	2.54	25	0.23	1	0.01	0	0.00
Total	11,472		292		27		1		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	170	97.64	4	2.29	0	0.06	0	0.00	0	0.00
Masonry	1,147	95.66	41	3.45	10	0.86	0	0.03	0	0.00
MH	238	99.97	0	0.02	0	0.01	0	0.00	0	0.00
Steel	556	98.02	10	1.81	1	0.16	0	0.01	0	0.00
Wood	9,383	97.64	218	2.27	8	0.09	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 52 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	0	0	1
Police Stations	2	0	0	2
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 5,601 tons of debris will be generated. Of the total amount, 2,358 tons (42%) is Other Tree Debris. Of the remaining 3,243 tons, Brick/Wood comprises 35% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 46 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,101 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 10.9 million dollars, which represents 0.36 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 11 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 94% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	8,273.17	346.12	89.82	46.88	8,755.99
	Content	1,383.93	47.22	19.20	3.96	1,454.31
	Inventory	0.00	1.17	3.56	0.20	4.93
	Subtotal	9,657.10	394.51	112.58	51.04	10,215.23
<u>Business Interruption Loss</u>						
	Income	0.00	35.90	0.00	0.00	35.90
	Relocation	332.72	27.65	0.68	0.51	361.55
	Rental	261.13	16.18	0.00	0.00	277.31
	Wage	0.00	12.75	0.00	0.00	12.75
	Subtotal	593.84	92.48	0.68	0.51	687.51
<u>Total</u>						
	Total	10,250.95	486.99	113.25	51.55	10,902.74

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	46	99.77	0	0.22	0	0.00	0	0.00	0	0.00
Commercial	739	99.70	2	0.30	0	0.00	0	0.00	0	0.00
Education	28	99.69	0	0.31	0	0.00	0	0.00	0	0.00
Government	12	99.66	0	0.34	0	0.00	0	0.00	0	0.00
Industrial	268	99.67	1	0.33	0	0.00	0	0.00	0	0.00
Religion	44	99.75	0	0.25	0	0.01	0	0.00	0	0.00
Residential	10,640	99.89	11	0.10	1	0.01	0	0.00	0	0.00
Total	11,777		14		1		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	173	99.60	1	0.40	0	0.00	0	0.00	0	0.00
Masonry	1,193	99.48	6	0.50	0	0.02	0	0.00	0	0.00
MH	238	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	565	99.66	2	0.34	0	0.00	0	0.00	0	0.00
Wood	9,606	99.96	4	0.04	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 52 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	0	0	1
Police Stations	2	0	0	2
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 258 tons of debris will be generated. Of the total amount, 99 tons (38%) is Other Tree Debris. Of the remaining 159 tons, Brick/Wood comprises 37% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 100 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.8 million dollars, which represents 0.03 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	618.25	54.67	18.39	6.72	698.04
	Content	130.37	0.00	0.00	0.00	130.37
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	748.62	54.67	18.39	6.72	828.41
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	6.35	0.10	0.00	0.02	6.47
	Rental	9.89	0.00	0.00	0.00	9.89
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	16.24	0.10	0.00	0.02	16.36
<u>Total</u>						
	Total	764.86	54.77	18.39	6.74	844.76

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Hazus-MH: Hurricane Event Report

Region Name: Branford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 22.55 square miles and contains 7 census tracts. There are over 12 thousand households in the region and has a total population of 28,683 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 2,997 million dollars (2006 dollars). Approximately 90% of the buildings (and 71% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,792 buildings in the region which have an aggregate total replacement value of 2,997 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,131,709	71.1%
Commercial	589,389	19.7%
Industrial	193,528	6.5%
Agricultural	9,230	0.3%
Religious	34,032	1.1%
Government	9,150	0.3%
Education	29,669	1.0%
Total	2,996,707	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 52 beds. There are 9 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	46	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	741	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	28	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	12	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	269	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	10,652	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	11,792		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	174	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,199	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	238	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	567	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	9,610	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 52 hospital beds available for use. On the day of the hurricane, the model estimates that 52 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	1	0	0	1
Police Stations	2	0	0	2
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 28,683) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	28,683	2,131,709	864,998	2,996,707
Total	28,683	2,131,709	864,998	2,996,707
Study Region Total	28,683	2,131,709	864,998	2,996,707

Debris Summary Report: 10 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	59	0	100	99	258
Total	59	0	100	99	258
Study Region Total	59	0	100	99	258

Debris Summary Report: 50 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1,142	0	2,101	2,358	5,601
Total	1,142	0	2,101	2,358	5,601
Study Region Total	1,142	0	2,101	2,358	5,601

Debris Summary Report: 100 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	4,127	2	4,720	5,053	13,902
Total	4,127	2	4,720	5,053	13,902
Study Region Total	4,127	2	4,720	5,053	13,902

Debris Summary Report: 200 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	10,804	41	9,372	10,533	30,750
Total	10,804	41	9,372	10,533	30,750
Study Region Total	10,804	41	9,372	10,533	30,750

Debris Summary Report: 500 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	29,712	293	22,249	25,719	77,973
Total	29,712	293	22,249	25,719	77,973
Study Region Total	29,712	293	22,249	25,719	77,973

Debris Summary Report: 1000 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	58,608	763	31,553	34,916	125,840
Total	58,608	763	31,553	34,916	125,840
Study Region Total	58,608	763	31,553	34,916	125,840

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

356

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,870	718	11	0.06	170	28	34	82	2,914
Total	1,870	718	11	0.06	170	28	34	82	2,914
Study Region Total	1,870	718	11	0.06	170	28	34	82	2,914

Direct Economic Losses For Buildings: 10 - year Event

357

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

358

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	698	130	0	0.02	6	0	0	10	845
Total	698	130	0	0.02	6	0	0	10	845
Study Region Total	698	130	0	0.02	6	0	0	10	845

Direct Economic Losses For Buildings: 50 - year Event

359

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	8,756	1,454	5	0.29	362	36	13	277	10,903
Total	8,756	1,454	5	0.29	362	36	13	277	10,903
Study Region Total	8,756	1,454	5	0.29	362	36	13	277	10,903

Direct Economic Losses For Buildings: 100 - year Event

360

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	26,007	5,338	59	0.87	1,267	248	352	957	34,230
Total	26,007	5,338	59	0.87	1,267	248	352	957	34,230
Study Region Total	26,007	5,338	59	0.87	1,267	248	352	957	34,230

Direct Economic Losses For Buildings: 200 - year Event

361

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	69,767	21,029	365	2.33	5,841	856	1,216	3,127	102,202
Total	69,767	21,029	365	2.33	5,841	856	1,216	3,127	102,202
Study Region Total	69,767	21,029	365	2.33	5,841	856	1,216	3,127	102,202

Direct Economic Losses For Buildings: 500 - year Event

362

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	211,022	84,559	1,359	7.04	23,700	1,796	2,338	10,433	335,206
Total	211,022	84,559	1,359	7.04	23,700	1,796	2,338	10,433	335,206
Study Region Total	211,022	84,559	1,359	7.04	23,700	1,796	2,338	10,433	335,206

Direct Economic Losses For Buildings: 1000 - year Event

363

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	431,369	195,475	3,183	14.39	47,402	7,861	9,178	20,583	715,050
Total	431,369	195,475	3,183	14.39	47,402	7,861	9,178	20,583	715,050
Study Region Total	431,369	195,475	3,183	14.39	47,402	7,861	9,178	20,583	715,050

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Hazus-MH: Earthquake Event Report

Region Name: hamden eq

Earthquake Scenario: Hamden_Annualized

Print Date: March 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region which has a total population of 56,913 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 (millions of dollars). Approximately 93.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 659 and 39 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 16 thousand buildings in the region which have an aggregate total replacement value of 5,606 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 88% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 26 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 7 dams identified within the region. Of these, 5 of the dams are classified as 'high hazard'. The inventory also includes 13 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 698.00 (millions of dollars). This inventory includes over 47 kilometers of highways, 36 bridges, 815 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	36	368.60
	Segments	20	281.20
	Tunnels	0	0.00
	Subtotal		649.80
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	5	8.60
	Tunnels	0	0.00
	Subtotal		8.60
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			659.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.20
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		46.40
Waste Water	Distribution Lines	NA	4.90
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.90
Natural Gas	Distribution Lines	NA	3.30
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		3.30
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	8	0.90
	Subtotal		0.90
Total			55.50

Earthquake Scenario

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

Scenario Name	Hamden_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	26	0	0	0
EOCs	0	0	0	0
PoliceStations	1	0	0	0
FireStations	2	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	0	0
	Bridges	36	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	5	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	8	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	408	0	0
Waste Water	245	0	0
Natural Gas	163	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	22,408	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
	Total				

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	281.20	\$0.00	0.00
	Bridges	368.59	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	649.80	0.00	
Railways	Segments	8.64	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	8.60	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.00
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	659.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	8.20	\$0.00	0.00
	Subtotal	46.45	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.90	\$0.00	0.00
	Subtotal	4.89	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	3.26	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.90	\$0.00	0.00
	Subtotal	0.92	\$0.00	
	Total	55.52	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	56,913	4,215	1,390	5,606
Total State		56,913	4,215	1,390	5,606
Total Region		56,913	4,215	1,390	5,606

Hazus-MH: Earthquake Event Report

Region Name: hamden eq

Earthquake Scenario: Hamden_EQ_100_Year

Print Date: March 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region which has a total population of 56,913 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 (millions of dollars). Approximately 93.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 659 and 39 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 16 thousand buildings in the region which have an aggregate total replacement value of 5,606 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 88% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 26 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 7 dams identified within the region. Of these, 5 of the dams are classified as 'high hazard'. The inventory also includes 13 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 698.00 (millions of dollars). This inventory includes over 47 kilometers of highways, 36 bridges, 815 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	36	368.60
	Segments	20	281.20
	Tunnels	0	0.00
	Subtotal		649.80
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	5	8.60
	Tunnels	0	0.00
	Subtotal		8.60
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			659.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.20
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		46.40
Waste Water	Distribution Lines	NA	4.90
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.90
Natural Gas	Distribution Lines	NA	3.30
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		3.30
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	8	0.90
	Subtotal		0.90
Total			55.50

Earthquake Scenario

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

Scenario Name	Hamden_EQ_100_Year
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	6	0.04	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	695	4.33	0	0.00	0	0.00	0	0.00	0	0.00
Education	67	0.42	0	0.00	0	0.00	0	0.00	0	0.00
Government	229	1.43	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	76	0.47	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	1,163	7.25	0	0.00	0	0.00	0	0.00	0	0.00
Religion	105	0.65	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	13,692	85.40	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,033		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	14,045	87.60	0	0.00	0	0.00	0	0.00	0	0.00
Steel	574	3.58	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	141	0.88	0	0.00	0	0.00	0	0.00	0	0.00
Precast	47	0.29	0	0.00	0	0.00	0	0.00	0	0.00
RM	198	1.23	0	0.00	0	0.00	0	0.00	0	0.00
URM	1,029	6.42	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,033		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	26	0	0	26
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	36	0	0	36	36
	Tunnels	0	0	0	0	0
Railways	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	8	0	0	8	8

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	408	0	0
Waste Water	245	0	0
Natural Gas	163	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	22,408	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	281.20	\$0.00	0.00
	Bridges	368.59	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	649.80	0.00	
Railways	Segments	8.64	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	8.60	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.02
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	659.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	8.20	\$0.00	0.00
	Subtotal	46.45	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.90	\$0.00	0.00
	Subtotal	4.89	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	3.26	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.90	\$0.00	0.00
	Subtotal	0.92	\$0.00	
	Total	55.52	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	56,913	4,215	1,390	5,606
Total State		56,913	4,215	1,390	5,606
Total Region		56,913	4,215	1,390	5,606

Hazus-MH: Earthquake Event Report

Region Name: hamden eq

Earthquake Scenario: Hamden_Probabilistic_7

Print Date: March 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region which has a total population of 56,913 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 (millions of dollars). Approximately 93.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 659 and 39 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 16 thousand buildings in the region which have an aggregate total replacement value of 5,606 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 88% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 26 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 7 dams identified within the region. Of these, 5 of the dams are classified as 'high hazard'. The inventory also includes 13 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 698.00 (millions of dollars). This inventory includes over 47 kilometers of highways, 36 bridges, 815 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	36	368.60
	Segments	20	281.20
	Tunnels	0	0.00
	Subtotal		649.80
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	5	8.60
	Tunnels	0	0.00
	Subtotal		8.60
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			659.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.20
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		46.40
Waste Water	Distribution Lines	NA	4.90
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.90
Natural Gas	Distribution Lines	NA	3.30
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		3.30
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	8	0.90
	Subtotal		0.90
Total			55.50

Earthquake Scenario

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

Scenario Name	Hamden_Probabilistic_7
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	6	0.04	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	695	4.33	0	0.00	0	0.00	0	0.00	0	0.00
Education	67	0.42	0	0.00	0	0.00	0	0.00	0	0.00
Government	229	1.43	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	76	0.47	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	1,163	7.25	0	0.00	0	0.00	0	0.00	0	0.00
Religion	105	0.65	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	13,692	85.40	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,033		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	14,045	87.60	0	0.00	0	0.00	0	0.00	0	0.00
Steel	574	3.58	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	141	0.88	0	0.00	0	0.00	0	0.00	0	0.00
Precast	47	0.29	0	0.00	0	0.00	0	0.00	0	0.00
RM	198	1.23	0	0.00	0	0.00	0	0.00	0	0.00
URM	1,029	6.42	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,033		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	26	0	0	26
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	36	0	0	36	36
	Tunnels	0	0	0	0	0
Railways	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	8	0	0	8	8

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	408	0	0
Waste Water	245	0	0
Natural Gas	163	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	22,408	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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(Millions of dollars)

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	Bridges	368.59	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	649.80	0.00	
Railways	Segments	8.64	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	8.60	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.02
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	659.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	8.20	\$0.00	0.00
	Subtotal	46.45	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.90	\$0.00	0.00
	Subtotal	4.89	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	3.26	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.90	\$0.00	0.00
	Subtotal	0.92	\$0.00	
	Total	55.52	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	56,913	4,215	1,390	5,606
Total State		56,913	4,215	1,390	5,606
Total Region		56,913	4,215	1,390	5,606

Hazus-MH: Flood Event Report

Region Name: Hamden_500_year_Flood

Flood Scenario: 500 year

Print Date: Monday, March 11, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 33 square miles and contains 719 census blocks. The region contains over 22 thousand households and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 16,033 buildings in the region with a total building replacement value (excluding contents) of 5,609 million dollars (2006 dollars). Approximately 92.65% of the buildings (and 75.21% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,609 million (2006 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	4,218,703	75.2%
Commercial	554,099	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religion	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,609,313	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	757,568	62.7%
Commercial	163,206	13.5%
Industrial	30,129	2.5%
Agricultural	48	0.0%
Religion	15,457	1.3%
Government	157,632	13.1%
Education	83,384	6.9%
Total	1,207,424	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police station 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:	Hamden_500_year_Flood
Scenario Name:	500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	26	0	0	0

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.

The model estimates that a total of 35 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 130 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 93 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 2.88 million dollars, which represents 0.24 % 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 2.86 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 7.06% 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	0.10	0.22	0.03	0.20	0.55
	Content	0.10	0.74	0.06	1.24	2.14
	Inventory	0.00	0.03	0.14	0.00	0.17
	Subtotal	0.20	0.99	0.23	1.44	2.86
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.01	0.02
	Subtotal	0.00	0.01	0.00	0.01	0.02
ALL	Total	0.20	1.00	0.23	1.45	2.88

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,218,703	1,390,610	5,609,313
Total	56,913	4,218,703	1,390,610	5,609,313
Total Study Region	56,913	4,218,703	1,390,610	5,609,313

Hazus-MH: Flood Event Report

Region Name: Hamden_Updated_Inventory_Flood

Flood Scenario: Flood - 100 year

Print Date: Monday, March 11, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 33 square miles and contains 719 census blocks. The region contains over 22 thousand households and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 16,033 buildings in the region with a total building replacement value (excluding contents) of 5,609 million dollars (2006 dollars). Approximately 92.65% of the buildings (and 75.21% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,609 million (2006 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	4,218,703	75.2%
Commercial	554,099	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religion	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,609,313	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,408,627	62.5%
Commercial	280,908	12.5%
Industrial	30,591	1.4%
Agricultural	48	0.0%
Religion	31,401	1.4%
Government	157,629	7.0%
Education	343,457	15.2%
Total	2,252,661	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police station 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:	Hamden_Updated_Inventory_Flood
Scenario Name:	Flood - 100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 63 buildings will be at least moderately damaged. This is over 28% of the total number of buildings in the scenario. There are an estimated 14 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	1	11.11	7	77.78	1	11.11	0	0.00	0	0.00	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	1	50.00	1	50.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	3	5.66	19	35.85	17	32.08	14	26.42
Total	1		8		5		19		17		14	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	3	75.00	1	25.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	3	75.00	1	25.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	1	1.85	3	5.56	19	35.19	17	31.48	14	25.93

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	26	0	0	0

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.

The model estimates that a total of 4,697 tons of debris will be generated. Of the total amount, Finishes comprises 60% of the total, Structure comprises 24% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 188 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 693 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,467 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 103.33 million dollars, which represents 4.59 % 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 102.80 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 35.48% 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	22.18	7.95	1.08	4.93	36.13
	Content	14.45	20.25	2.95	26.27	63.91
	Inventory	0.00	0.72	2.02	0.02	2.76
	Subtotal	36.62	28.91	6.05	31.22	102.80
<u>Business Interruption</u>						
	Income	0.00	0.12	0.01	0.01	0.14
	Relocation	0.02	0.04	0.01	0.00	0.06
	Rental Income	0.01	0.02	0.00	0.00	0.03
	Wage	0.01	0.20	0.01	0.09	0.30
	Subtotal	0.04	0.37	0.03	0.09	0.53
ALL	Total	36.66	29.28	6.08	31.31	103.33

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,218,703	1,390,610	5,609,313
Total	56,913	4,218,703	1,390,610	5,609,313
Total Study Region	56,913	4,218,703	1,390,610	5,609,313

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name: UN-NAMED-1938-4
Type: Historic
Max Peak Gust in Study Region: 112 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,547 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 63 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	4	58.64	2	25.03	1	10.31	0	5.18	0	0.84
Commercial	462	66.42	147	21.20	71	10.28	14	2.08	0	0.02
Education	46	68.74	14	20.48	6	9.44	1	1.34	0	0.00
Government	189	82.65	27	11.58	12	5.08	2	0.70	0	0.00
Industrial	51	67.72	15	19.43	8	10.04	2	2.60	0	0.20
Religion	71	68.06	24	22.95	8	8.00	1	0.99	0	0.00
Residential	9,321	62.75	4,114	27.69	1,260	8.48	97	0.65	63	0.42
Total	10,144		4,342		1,366		117		63	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	115	61.52	42	22.53	27	14.67	2	1.27	0	0.00
Masonry	729	59.40	271	22.10	207	16.91	18	1.43	2	0.17
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	381	66.35	112	19.43	68	11.82	14	2.38	0	0.02
Wood	9,091	64.72	3,979	28.33	823	5.86	89	0.63	64	0.46

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 63,064 tons of debris will be generated. Of the total amount, 21,148 tons (34%) is Other Tree Debris. Of the remaining 41,916 tons, Brick/Wood comprises 59% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 992 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 17,110 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 359 households to be displaced due to the hurricane. Of these, 89 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 237.5 million dollars, which represents 4.24 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 237 million dollars. 7% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	139,752.90	8,444.25	854.59	10,424.11	159,475.85
	Content	43,761.89	3,181.94	666.19	4,216.53	51,826.55
	Inventory	0.00	108.60	392.69	14.86	516.15
	Subtotal	183,514.79	11,734.79	1,913.48	14,655.51	211,818.56
<u>Business Interruption Loss</u>						
	Income	0.24	936.56	47.93	252.27	1,237.01
	Relocation	11,315.70	2,389.47	303.17	593.34	14,601.68
	Rental	6,325.75	1,296.94	49.54	49.22	7,721.46
	Wage	0.58	1,104.60	75.64	928.45	2,109.26
	Subtotal	17,642.27	5,727.57	476.28	1,823.28	25,669.40
<u>Total</u>						
	Total	201,157.06	17,462.36	2,389.76	16,478.79	237,487.97

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Direct Economic Losses For Buildings: Annualized Losses

453

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	2,537	940	8	0.05	210	29	40	109	3,873
Total	2,537	940	8	0.05	210	29	40	109	3,873
Study Region Total	2,537	940	8	0.05	210	29	40	109	3,873

Direct Economic Losses For Buildings: 10 - year Event

454

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

455

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	402	126	0	0.01	1	0	0	0	530
Total	402	126	0	0.01	1	0	0	0	530
Study Region Total	402	126	0	0.01	1	0	0	0	530

Direct Economic Losses For Buildings: 50 - year Event

456

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	10,353	1,476	1	0.18	365	0	0	306	12,502
Total	10,353	1,476	1	0.18	365	0	0	306	12,502
Study Region Total	10,353	1,476	1	0.18	365	0	0	306	12,502

Direct Economic Losses For Buildings: 100 - year Event

457

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	33,623	5,525	36	0.60	1,801	357	547	1,497	43,386
Total	33,623	5,525	36	0.60	1,801	357	547	1,497	43,386
Study Region Total	33,623	5,525	36	0.60	1,801	357	547	1,497	43,386

Direct Economic Losses For Buildings: 200 - year Event

458

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	85,080	21,292	210	1.52	6,231	1,053	1,642	4,024	119,531
Total	85,080	21,292	210	1.52	6,231	1,053	1,642	4,024	119,531
Study Region Total	85,080	21,292	210	1.52	6,231	1,053	1,642	4,024	119,531

Direct Economic Losses For Buildings: 500 - year Event

459

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	273,332	102,193	1,025	4.88	27,978	1,563	2,645	13,338	422,074
Total	273,332	102,193	1,025	4.88	27,978	1,563	2,645	13,338	422,074
Study Region Total	273,332	102,193	1,025	4.88	27,978	1,563	2,645	13,338	422,074

Direct Economic Losses For Buildings: 1000 - year Event

460

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	589,390	255,742	2,414	10.51	59,438	6,560	9,138	26,815	949,498
Total	589,390	255,742	2,414	10.51	59,438	6,560	9,138	26,815	949,498
Study Region Total	589,390	255,742	2,414	10.51	59,438	6,560	9,138	26,815	949,498

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Hamden Hurricane Annualized
 Scenario : Probabilistic

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 5,041 buildings will be at least moderately damaged. This is over 31% of the total number of buildings in the region. There are an estimated 508 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	2	26.90	2	32.49	1	22.80	1	14.14	0	3.68
Commercial	227	32.67	187	26.84	186	26.73	95	13.60	1	0.16
Education	23	34.78	17	25.82	18	26.65	9	12.75	0	0.01
Government	143	62.34	35	15.22	36	15.53	16	6.91	0	0.00
Industrial	25	33.39	18	23.96	20	26.57	11	15.10	1	0.98
Religion	35	33.55	33	31.88	26	24.49	11	10.06	0	0.01
Residential	4,709	31.70	5,535	37.26	3,368	22.67	737	4.96	506	3.41
Total	5,165		5,827		3,654		879		508	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	52	27.68	41	22.12	69	37.07	25	13.14	0	0.00
Masonry	354	28.81	308	25.09	438	35.69	114	9.33	13	1.08
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	186	32.36	125	21.69	173	30.18	89	15.59	1	0.18
Wood	4,669	33.24	5,636	40.13	2,572	18.31	657	4.68	510	3.63

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	26	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 161,886 tons of debris will be generated. Of the total amount, 48,876 tons (30%) is Other Tree Debris. Of the remaining 113,011 tons, Brick/Wood comprises 66% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3025 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 37,381 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,898 households to be displaced due to the hurricane. Of these, 458 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 949.5 million dollars, which represents 16.94 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 949 million dollars. 8% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	499,256.68	37,325.73	3,885.24	48,922.43	589,390.08
	Content	205,414.79	19,551.88	3,626.33	27,148.92	255,741.92
	Inventory	0.00	587.37	1,771.58	55.19	2,414.13
	Subtotal	704,671.47	57,464.98	9,283.15	76,126.53	847,546.13
<u>Business Interruption Loss</u>						
	Income	91.87	5,905.07	241.16	322.21	6,560.31
	Relocation	46,090.80	9,697.16	1,129.76	2,520.37	59,438.09
	Rental	20,646.87	5,737.48	205.67	225.45	26,815.46
	Wage	216.36	7,356.21	383.60	1,181.41	9,137.58
	Subtotal	67,045.90	28,695.91	1,960.19	4,249.45	101,951.44
<u>Total</u>						
	Total	771,717.37	86,160.89	11,243.33	80,375.98	949,497.58

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

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Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 2,665 buildings will be at least moderately damaged. This is over 17% of the total number of buildings in the region. There are an estimated 165 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3	45.45	2	29.66	1	15.11	0	8.15	0	1.64
Commercial	368	52.95	175	25.23	116	16.75	35	5.02	0	0.05
Education	37	54.90	16	24.54	11	16.36	3	4.20	0	0.00
Government	172	74.92	32	14.11	20	8.90	5	2.07	0	0.00
Industrial	41	53.68	18	23.08	13	16.77	5	6.05	0	0.42
Religion	56	53.57	30	28.51	15	14.58	4	3.33	0	0.00
Residential	7,461	50.23	4,957	33.37	2,022	13.61	250	1.68	165	1.11
Total	8,137		5,230		2,199		301		165	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	88	47.00	46	24.59	45	24.16	8	4.25	0	0.00
Masonry	569	46.40	307	25.05	303	24.73	42	3.44	5	0.39
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	303	52.73	128	22.22	110	19.22	33	5.76	0	0.06
Wood	7,339	52.25	4,897	34.86	1,416	10.08	227	1.62	166	1.18

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	4	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 97,042 tons of debris will be generated. Of the total amount, 32,549 tons (34%) is Other Tree Debris. Of the remaining 64,493 tons, Brick/Wood comprises 60% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1566 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 25,355 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 696 households to be displaced due to the hurricane. Of these, 172 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 422.1 million dollars, which represents 7.53 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 422 million dollars. 8% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	235,927.28	15,380.41	1,727.00	20,297.79	273,332.48
	Content	84,132.18	6,838.90	1,486.78	9,735.38	102,193.24
	Inventory	0.00	230.74	768.22	26.00	1,024.96
	Subtotal	320,059.46	22,450.06	3,981.99	30,059.17	376,550.68
<u>Business Interruption Loss</u>						
	Income	5.75	1,230.45	94.26	232.65	1,563.11
	Relocation	21,855.25	4,391.72	569.37	1,161.49	27,977.83
	Rental	10,684.52	2,458.89	95.47	98.95	13,337.83
	Wage	13.55	1,493.83	148.73	988.68	2,644.80
	Subtotal	32,559.07	9,574.88	907.83	2,481.78	45,523.56
<u>Total</u>						
	Total	352,618.53	32,024.94	4,889.82	32,540.96	422,074.24

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 749 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 19 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	4	73.68	1	17.83	0	5.54	0	2.63	0	0.32
Commercial	553	79.59	103	14.83	34	4.84	5	0.73	0	0.00
Education	55	81.98	9	13.88	3	3.85	0	0.28	0	0.00
Government	207	90.33	17	7.56	5	1.97	0	0.14	0	0.00
Industrial	61	80.58	10	13.68	4	4.67	1	0.99	0	0.08
Religion	85	80.83	16	15.52	4	3.41	0	0.24	0	0.00
Residential	11,262	75.81	2,900	19.52	646	4.35	29	0.20	19	0.13
Total	12,227		3,057		694		36		19	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	142	75.99	32	17.13	12	6.60	1	0.29	0	0.00
Masonry	890	72.57	208	16.93	121	9.89	7	0.56	1	0.06
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	458	79.79	80	13.93	31	5.44	5	0.84	0	0.01
Wood	10,890	77.54	2,729	19.43	381	2.71	27	0.19	19	0.13

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 36,454 tons of debris will be generated. Of the total amount, 11,442 tons (31%) is Other Tree Debris. Of the remaining 25,012 tons, Brick/Wood comprises 58% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 586 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 10,359 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 171 households to be displaced due to the hurricane. Of these, 42 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 119.5 million dollars, which represents 2.13 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 120 million dollars. 6% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	76,454.96	3,937.35	370.03	4,317.20	85,079.53
	Content	18,566.44	1,163.99	249.44	1,312.28	21,292.15
	Inventory	0.00	41.07	162.18	6.72	209.97
	Subtotal	95,021.40	5,142.41	781.65	5,636.19	106,581.66
<u>Business Interruption Loss</u>						
	Income	0.00	828.53	26.91	197.43	1,052.87
	Relocation	4,716.21	1,118.36	133.69	262.66	6,230.92
	Rental	3,356.64	622.11	22.95	21.98	4,023.68
	Wage	0.00	923.14	41.95	677.22	1,642.31
	Subtotal	8,072.85	3,492.14	225.50	1,159.29	12,949.78
<u>Total</u>						
	Total	103,094.25	8,634.55	1,007.16	6,795.49	119,531.44

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name: Probabilistic
Type: Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 183 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	5	90.19	0	7.60	0	1.52	0	0.64	0	0.05
Commercial	647	93.13	40	5.80	7	0.96	1	0.11	0	0.00
Education	63	94.05	4	5.42	0	0.51	0	0.01	0	0.00
Government	222	96.90	7	2.86	1	0.24	0	0.00	0	0.00
Industrial	71	93.36	4	5.62	1	0.84	0	0.18	0	0.01
Religion	98	93.57	6	5.92	1	0.49	0	0.02	0	0.00
Residential	13,454	90.57	1,228	8.26	168	1.13	4	0.03	1	0.01
Total	14,560		1,289		177		5		1	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	171	91.61	14	7.40	2	0.98	0	0.01	0	0.00
Masonry	1,082	88.17	103	8.42	40	3.29	1	0.12	0	0.01
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	535	93.20	33	5.68	6	1.00	1	0.12	0	0.00
Wood	12,873	91.65	1,093	7.79	74	0.53	3	0.02	1	0.01

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	26

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 19,127 tons of debris will be generated. Of the total amount, 7,285 tons (38%) is Other Tree Debris. Of the remaining 11,842 tons, Brick/Wood comprises 49% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 234 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 5,987 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 42 households to be displaced due to the hurricane. Of these, 11 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 43.4 million dollars, which represents 0.77 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 43 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	31,380.43	1,075.18	83.06	1,084.38	33,623.05
	Content	5,146.44	181.70	31.44	165.83	5,525.42
	Inventory	0.00	6.53	28.52	1.26	36.31
	Subtotal	36,526.87	1,263.41	143.03	1,251.47	39,184.78
<u>Business Interruption Loss</u>						
	Income	0.00	279.33	5.64	71.91	356.88
	Relocation	1,431.73	287.50	21.78	59.57	1,800.59
	Rental	1,312.78	174.37	4.37	5.77	1,497.29
	Wage	0.00	347.30	8.79	190.65	546.73
	Subtotal	2,744.51	1,088.50	40.57	327.90	4,201.49
<u>Total</u>						
	Total	39,271.38	2,351.92	183.60	1,579.38	43,386.28

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 20 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	6	98.41	0	1.42	0	0.13	0	0.03	0	0.00
Commercial	686	98.67	9	1.24	1	0.09	0	0.00	0	0.00
Education	66	98.75	1	1.24	0	0.02	0	0.00	0	0.00
Government	227	99.30	2	0.69	0	0.01	0	0.00	0	0.00
Industrial	75	98.63	1	1.32	0	0.05	0	0.01	0	0.00
Religion	104	98.86	1	1.11	0	0.03	0	0.00	0	0.00
Residential	14,615	98.39	220	1.48	19	0.13	1	0.00	0	0.00
Total	15,779		234		19		1		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	184	98.16	3	1.82	0	0.03	0	0.00	0	0.00
Masonry	1,190	97.02	31	2.49	6	0.48	0	0.01	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	566	98.54	8	1.39	0	0.08	0	0.00	0	0.00
Wood	13,880	98.83	159	1.13	5	0.04	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	26

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3,213 tons of debris will be generated. Of the total amount, 781 tons (24%) is Other Tree Debris. Of the remaining 2,432 tons, Brick/Wood comprises 57% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 55 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,046 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 12.5 million dollars, which represents 0.22 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 13 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 96% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	9,934.70	207.14	13.18	198.02	10,353.04
	Content	1,463.38	12.61	0.00	0.01	1,476.00
	Inventory	0.00	0.44	0.90	0.06	1.39
	Subtotal	11,398.08	220.19	14.09	198.08	11,830.44
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	359.18	5.32	0.33	0.39	365.21
	Rental	306.28	0.00	0.00	0.00	306.28
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	665.46	5.32	0.33	0.39	671.49
<u>Total</u>						
	Total	12,063.54	225.50	14.41	198.48	12,501.93

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	6	99.80	0	0.21	0	0.00	0	0.00	0	0.00
Commercial	693	99.75	2	0.25	0	0.00	0	0.00	0	0.00
Education	67	99.73	0	0.27	0	0.00	0	0.00	0	0.00
Government	229	99.84	0	0.16	0	0.00	0	0.00	0	0.00
Industrial	76	99.72	0	0.28	0	0.00	0	0.00	0	0.00
Religion	105	99.79	0	0.21	0	0.00	0	0.00	0	0.00
Residential	14,840	99.90	14	0.10	1	0.00	0	0.00	0	0.00
Total	16,015		17		1		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	186	99.63	1	0.37	0	0.00	0	0.00	0	0.00
Masonry	1,222	99.58	5	0.41	0	0.01	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	572	99.70	2	0.30	0	0.00	0	0.00	0	0.00
Wood	14,041	99.97	3	0.02	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	26

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 231 tons of debris will be generated. Of the total amount, 58 tons (25%) is Other Tree Debris. Of the remaining 173 tons, Brick/Wood comprises 32% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 118 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.5 million dollars, which represents 0.01 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	402.10	0.00	0.00	0.00	402.10
	Content	126.46	0.00	0.00	0.00	126.46
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	528.56	0.00	0.00	0.00	528.56
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	1.13	0.00	0.00	0.00	1.13
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	1.13	0.00	0.00	0.00	1.13
<u>Total</u>						
	Total	529.69	0.00	0.00	0.00	529.69

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Hurricane Event Report

Region Name: Hamden_Hurricane

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Friday, March 15, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 33.27 square miles and contains 12 census tracts. There are over 22 thousand households in the region and has a total population of 56,913 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 5,606 million dollars (2006 dollars). Approximately 93% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,033 buildings in the region which have an aggregate total replacement value of 5,606 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	4,215,995	75.2%
Commercial	553,875	9.9%
Industrial	50,627	0.9%
Agricultural	101	0.0%
Religious	79,333	1.4%
Government	242,641	4.3%
Education	463,809	8.3%
Total	5,606,381	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 26 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	6	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	695	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	67	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	229	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	76	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	105	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	14,855	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,033		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	187	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,227	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	574	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	14,045	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	26	0	0	26

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 56,913) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	56,913	4,215,995	1,390,386	5,606,381
Total	56,913	4,215,995	1,390,386	5,606,381
Study Region Total	56,913	4,215,995	1,390,386	5,606,381

Hazus-MH: Earthquake Event Report

Region Name: Madison_EQ

Earthquake Scenario: Madison_Annualized

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 36.71 square miles and contains 3 census tracts. There are over 6 thousand households in the region which has a total population of 17,858 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,028 (millions of dollars). Approximately 91.00 % of the buildings (and 79.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 646 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 2,028 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 87% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 11 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 646.00 (millions of dollars). This inventory includes over 61 kilometers of highways, 29 bridges, 599 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	29	282.00
	Segments	21	296.20
	Tunnels	0	0.00
	Subtotal		578.10
Railways	Bridges	1	0.10
	Facilities	0	0.00
	Segments	1	8.40
	Tunnels	0	0.00
	Subtotal		8.50
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	2	8.30
	Tunnels	0	0.00
	Subtotal		10.90
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	1	10.70
	Runways	1	38.00
	Subtotal		48.60
Total			646.10

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	6.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		6.00
Waste Water	Distribution Lines	NA	3.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		3.60
Natural Gas	Distribution Lines	NA	2.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.40
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
		Total	12.00

Earthquake Scenario

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

Scenario Name	Madison_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	11	0	0	0
EOCs	0	0	0	0
PoliceStations	1	0	0	0
FireStations	2	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	21	0	0	0	0
	Bridges	29	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	0	0
	Bridges	1	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	2	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	0	0
	Runways	1	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	300	0	0
Waste Water	180	0	0
Natural Gas	120	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	6,515	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.01 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 71 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	296.17	\$0.00	0.00
	Bridges	281.96	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	578.10	0.00	
Railways	Segments	8.38	\$0.00	0.00
	Bridges	0.09	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	8.50	0.00	
Light Rail	Segments	8.27	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	10.90	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	10.65	\$0.00	0.00
	Runways	37.96	\$0.00	0.00
	Subtotal	48.60	0.00	
	Total	646.10	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	6.00	\$0.00	0.00
	Subtotal	5.99	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	3.60	\$0.00	0.00
	Subtotal	3.59	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.40	\$0.00	0.00
	Subtotal	2.40	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	11.98	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	17,858	1,608	419	2,028
Total State		17,858	1,608	419	2,028
Total Region		17,858	1,608	419	2,028

Hazus-MH: Earthquake Event Report

Region Name: Madison_EQ

Earthquake Scenario: Madison_Probabilistic_MM_7_100yr

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 36.71 square miles and contains 3 census tracts. There are over 6 thousand households in the region which has a total population of 17,858 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,028 (millions of dollars). Approximately 91.00 % of the buildings (and 79.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 646 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 2,028 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 87% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 11 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 646.00 (millions of dollars). This inventory includes over 61 kilometers of highways, 29 bridges, 599 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	29	282.00
	Segments	21	296.20
	Tunnels	0	0.00
	Subtotal		578.10
Railways	Bridges	1	0.10
	Facilities	0	0.00
	Segments	1	8.40
	Tunnels	0	0.00
	Subtotal		8.50
Light Rail	Bridges	0	0.00
	Facilities	1	2.70
	Segments	2	8.30
	Tunnels	0	0.00
	Subtotal		10.90
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	1	10.70
	Runways	1	38.00
	Subtotal		48.60
Total			646.10

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	6.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		6.00
Waste Water	Distribution Lines	NA	3.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		3.60
Natural Gas	Distribution Lines	NA	2.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.40
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
		Total	12.00

Earthquake Scenario

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

Scenario Name	Madison_Probabilistic_MM_7_100yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	31	0.38	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	467	5.78	0	0.00	0	0.00	0	0.00	0	0.00
Education	21	0.26	0	0.00	0	0.00	0	0.00	0	0.00
Government	10	0.12	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	156	1.93	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	471	5.83	0	0.00	0	0.00	0	0.00	0	0.00
Religion	32	0.40	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	6,896	85.30	0	0.00	0	0.00	0	0.00	0	0.00
Total	8,084		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	7,038	87.06	0	0.00	0	0.00	0	0.00	0	0.00
Steel	335	4.14	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	63	0.77	0	0.00	0	0.00	0	0.00	0	0.00
Precast	22	0.27	0	0.00	0	0.00	0	0.00	0	0.00
RM	97	1.20	0	0.00	0	0.00	0	0.00	0	0.00
URM	518	6.41	0	0.00	0	0.00	0	0.00	0	0.00
MH	11	0.14	0	0.00	0	0.00	0	0.00	0	0.00
Total	8,084		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	11	0	0	11
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	21	0	0	21	21
	Bridges	29	0	0	29	29
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	1	0	0	1	1
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	300	0	0
Waste Water	180	0	0
Natural Gas	120	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	6,515	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	296.17	\$0.00	0.00
	Bridges	281.96	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	578.10	0.00	
Railways	Segments	8.38	\$0.00	0.00
	Bridges	0.09	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	8.50	0.00	
Light Rail	Segments	8.27	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	10.90	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	10.65	\$0.00	0.00
	Runways	37.96	\$0.00	0.00
	Subtotal	48.60	0.00	
	Total	646.10	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	6.00	\$0.00	0.00
	Subtotal	5.99	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	3.60	\$0.00	0.00
	Subtotal	3.59	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.40	\$0.00	0.00
	Subtotal	2.40	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	11.98	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	17,858	1,608	419	2,028
Total State		17,858	1,608	419	2,028
Total Region		17,858	1,608	419	2,028

Hazus-MH: Flood Event Report

Region Name: Madison_100_Coastal

Flood Scenario: Coastal 100 Year

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 36 square miles and contains 287 census blocks. The region contains over 7 thousand households and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,084 buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91.13% of the buildings (and 79.30% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 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	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religion	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	245,704	82.3%
Commercial	41,331	13.8%
Industrial	7,047	2.4%
Agricultural	485	0.2%
Religion	3,855	1.3%
Government	209	0.1%
Education	0	0.0%
Total	298,631	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police station 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:	Madison_100_Coastal
Scenario Name:	Coastal 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 37 buildings will be at least moderately damaged. This is over 24% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	19	51.35	17	45.95	1	2.70	0	0.00	0	0.00
Total	0		19		17		1		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	19	51.35	17	45.95	1	2.70	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	11	0	0	0

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.

The model estimates that a total of 1,078 tons of debris will be generated. Of the total amount, Finishes comprises 47% of the total, Structure comprises 33% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 43 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 90 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 140 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 7.80 million dollars, which represents 2.61 % 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 7.74 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 72.69% 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	3.37	0.33	0.20	0.02	3.92
	Content	2.29	0.83	0.46	0.18	3.76
	Inventory	0.00	0.01	0.06	0.00	0.07
	Subtotal	5.66	1.17	0.71	0.21	7.74
<u>Business Interruption</u>						
	Income	0.00	0.02	0.00	0.00	0.02
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.00	0.02
	Subtotal	0.01	0.04	0.00	0.00	0.05
ALL	Total	5.67	1.21	0.71	0.21	7.80

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Total Study Region	17,858	1,608,845	419,950	2,028,795

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100_Coastal
 Scenario: Coastal 100 Year
 Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100_Coastal
 Scenario: Coastal 100 Year
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	3,916	3,762	65	1.30	11	22	18	2	7,796
Total	3,916	3,762	65	1.30	11	22	18	2	7,796
Scenario Total	3,916	3,762	65	1.30	11	22	18	2	7,796

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100_Coastal
 Scenario: Coastal 100 Year
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Total					
Total					
Scenario Total					

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut										
	New Haven	3,916	3,762	65	1.3	11	22	18	2	7,796
	Total	3,916	3,762	65	1.3	11	22	18	2	7,796
Scenario Total		3,916	3,762	65	1.3	11	22	18	2	7,796

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100_Coastal
 Scenario: Coastal 100 Year
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Madison_100yr_Riverine

Flood Scenario: Riverine 100 year

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 36 square miles and contains 287 census blocks. The region contains over 7 thousand households and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,084 buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91.13% of the buildings (and 79.30% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 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	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religion	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,125,930	82.4%
Commercial	168,043	12.3%
Industrial	34,320	2.5%
Agricultural	3,278	0.2%
Religion	14,259	1.0%
Government	5,280	0.4%
Education	14,970	1.1%
Total	1,366,080	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police station 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:	Madison_100yr_Riverine
Scenario Name:	Riverine 100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 75 buildings will be at least moderately damaged. This is over 17% of the total number of buildings in the scenario. There are an estimated 11 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	4	5.33	12	16.00	25	33.33	23	30.67	11	14.67
Total	0		4		12		25		23		11	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	4	5.33	12	16.00	25	33.33	23	30.67	11	14.67

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	11	0	0	0

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.

The model estimates that a total of 2,210 tons of debris will be generated. Of the total amount, Finishes comprises 56% of the total, Structure comprises 27% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 88 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 676 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,329 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 54.83 million dollars, which represents 4.01 % 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 54.54 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 50.07% 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	17.76	5.07	0.75	0.69	24.27
	Content	9.66	14.93	1.42	3.59	29.61
	Inventory	0.00	0.46	0.18	0.03	0.67
	Subtotal	27.43	20.46	2.35	4.30	54.54
<u>Business Interruption</u>						
	Income	0.00	0.07	0.00	0.01	0.08
	Relocation	0.02	0.02	0.00	0.00	0.04
	Rental Income	0.00	0.01	0.00	0.00	0.01
	Wage	0.00	0.07	0.00	0.08	0.15
	Subtotal	0.03	0.17	0.00	0.09	0.28
ALL	Total	27.45	20.63	2.35	4.39	54.83

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Total Study Region	17,858	1,608,845	419,950	2,028,795

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100yr_Riverine
Scenario: Riverine 100 year
Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$4.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4.51
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$4.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4.51
Total	\$4.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4.51
Scenario Total	\$4.51	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4.51

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100yr_Riverine
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut	New Haven	24,270	29,608	665	1.80	38	79	154	11	54,825
	Total	24,270	29,608	665	1.80	38	79	154	11	54,825
	Scenario Total	24,270	29,608	665	1.80	38	79	154	11	54,825

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100yr_Riverine
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Total					
Total					
Scenario Total					

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut										
	New Haven	24,270	29,608	665	1.8	38	79	154	11	54,825
	Total	24,270	29,608	665	1.8	38	79	154	11	54,825
Scenario Total		24,270	29,608	665	1.8	38	79	154	11	54,825

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison_100yr_Riverine
 Scenario: Riverine 100 year
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Madison 500 year Riverine

Flood Scenario: 500 year Riverine

Print Date: Wednesday, January 30, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 36 square miles and contains 287 census blocks. The region contains over 7 thousand households and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,084 buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91.13% of the buildings (and 79.30% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 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	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religion	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	889,650	79.4%
Commercial	156,370	14.0%
Industrial	38,521	3.4%
Agricultural	2,755	0.2%
Religion	14,228	1.3%
Government	5,213	0.5%
Education	13,893	1.2%
Total	1,120,630	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police station 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:	Madison 500 year Riverine
Scenario Name:	500 year Riverine
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 18 buildings will be at least moderately damaged. This is over 20% of the total number of buildings in the scenario. There are an estimated 6 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	2	11.11	4	22.22	6	33.33	6	33.33
Total	0		0		2		4		6		6	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	2	11.11	4	22.22	6	33.33	6	33.33

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	11	0	0	0

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.

The model estimates that a total of 269 tons of debris will be generated. Of the total amount, Finishes comprises 45% of the total, Structure comprises 32% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 11 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 209 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 252 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 8.94 million dollars, which represents 0.80 % 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 8.93 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 78.70% 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	4.65	0.40	0.16	0.02	5.23
	Content	2.38	0.81	0.33	0.13	3.65
	Inventory	0.00	0.01	0.04	0.00	0.05
	Subtotal	7.03	1.22	0.53	0.15	8.93
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.01
ALL	Total	7.03	1.22	0.53	0.15	8.94

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Total Study Region	17,858	1,608,845	419,950	2,028,795

Direct Economic Loss For Agriculture Products

January 30, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Total					
Total					
Scenario Total					

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison 500 year Riverine
Scenario: 500 year Riverine
Return Period: 500

Direct Economic Annualized Losses for Buildings

January 30, 2013

All values are in thousands of dollars

		Capital Stock Losses				Income Losses				
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut										
	New Haven	5,231	3,648	52	0.5	4	2	0	0	8,937
	Total	5,231	3,648	52	0.5	4	2	0	0	8,937
Scenario Total		5,231	3,648	52	0.5	4	2	0	0	8,937

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Madison 500 year Riverine
 Scenario: 500 year Riverine
 Return Period: 500

Hazus-MH: Hurricane Event Report

Region Name: Madison 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name: UN-NAMED-1938-4
Type: Historic
Max Peak Gust in Study Region: 118 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,034 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the region. There are an estimated 80 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	16	52.77	9	27.69	4	12.22	2	6.18	0	1.14
Commercial	265	56.80	116	24.77	69	14.73	17	3.66	0	0.03
Education	13	60.09	5	24.09	3	13.12	1	2.70	0	0.00
Government	6	59.44	2	23.63	1	13.94	0	2.98	0	0.00
Industrial	91	58.04	36	22.77	23	14.57	7	4.39	0	0.22
Religion	18	56.82	9	27.75	4	12.83	1	2.60	0	0.00
Residential	4,025	54.64	2,440	33.11	711	9.65	112	1.52	80	1.08
Total	4,434		2,616		814		139		80	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	47	55.72	20	23.39	15	17.51	3	3.37	0	0.00
Masonry	336	54.76	158	25.70	100	16.24	18	2.90	2	0.40
MH	9	92.74	0	4.09	0	2.57	0	0.15	0	0.45
Steel	195	58.18	71	21.24	52	15.49	17	5.03	0	0.05
Wood	3,860	54.86	2,360	33.53	642	9.12	102	1.45	74	1.05

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 88,227 tons of debris will be generated. Of the total amount, 55,159 tons (63%) is Other Tree Debris. Of the remaining 33,068 tons, Brick/Wood comprises 33% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 444 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 21,964 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 126 households to be displaced due to the hurricane. Of these, 24 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 148.5 million dollars, which represents 7.32 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 148 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 87% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	84,360.48	7,923.06	1,384.97	1,197.95	94,866.46
	Content	34,582.62	3,221.82	908.34	468.70	39,181.49
	Inventory	0.00	61.14	119.67	9.59	190.40
	Subtotal	118,943.10	11,206.02	2,412.98	1,676.24	134,238.35
<u>Business Interruption Loss</u>						
	Income	2.22	556.67	12.81	55.75	627.44
	Relocation	7,424.20	1,521.05	136.74	238.93	9,320.92
	Rental	2,411.42	872.32	16.23	18.75	3,318.73
	Wage	5.23	528.71	21.35	406.53	961.82
	Subtotal	9,843.08	3,478.75	187.13	719.96	14,228.92
<u>Total</u>						
	Total	128,786.18	14,684.77	2,600.11	2,396.20	148,467.26

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	11,000	104	21,964	55,159	88,227
Total	11,000	104	21,964	55,159	88,227
Study Region Total	11,000	104	21,964	55,159	88,227

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

633

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	94,866	39,181	190	4.68	9,321	627	962	3,319	148,467
Total	94,866	39,181	190	4.68	9,321	627	962	3,319	148,467
Study Region Total	94,866	39,181	190	4.68	9,321	627	962	3,319	148,467

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 2,844 buildings will be at least moderately damaged. This is over 35% of the total number of buildings in the region. There are an estimated 424 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	7	23.65	10	33.00	8	24.46	5	14.90	1	3.99
Commercial	127	27.10	125	26.79	139	29.85	75	16.06	1	0.20
Education	6	29.02	6	26.44	6	29.30	3	15.23	0	0.01
Government	3	29.02	3	25.05	3	29.74	2	16.18	0	0.01
Industrial	44	28.14	37	23.67	46	29.27	28	18.08	1	0.85
Religion	9	26.87	10	31.61	9	28.14	4	13.34	0	0.04
Residential	1,998	27.12	2,856	38.76	1,568	21.28	524	7.12	421	5.71
Total	2,194		3,046		1,779		641		424	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	22	26.19	19	21.93	29	34.50	15	17.39	0	0.00
Masonry	164	26.64	164	26.77	192	31.27	82	13.36	12	1.95
MH	8	79.47	1	7.18	1	8.75	0	1.36	0	3.24
Steel	95	28.31	70	21.02	100	29.90	69	20.45	1	0.31
Wood	1,908	27.12	2,799	39.77	1,461	20.76	479	6.81	390	5.54

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	11	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 170,513 tons of debris will be generated. Of the total amount, 98,626 tons (58%) is Other Tree Debris. Of the remaining 71,887 tons, Brick/Wood comprises 46% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1344 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 38,281 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 679 households to be displaced due to the hurricane. Of these, 129 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 470.9 million dollars, which represents 23.21 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 471 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	251,229.61	26,595.45	4,740.18	4,077.95	286,643.18
	Content	112,903.95	14,231.03	3,559.81	2,126.78	132,821.57
	Inventory	0.00	249.58	450.59	28.37	728.55
	Subtotal	364,133.56	41,076.05	8,750.58	6,233.10	420,193.30
<u>Business Interruption Loss</u>						
	Income	59.70	4,596.98	55.84	69.53	4,782.05
	Relocation	24,104.00	4,772.42	393.58	787.43	30,057.43
	Rental	7,686.98	2,946.84	53.74	67.00	10,754.55
	Wage	140.57	4,492.91	93.48	423.00	5,149.97
	Subtotal	31,991.25	16,809.16	596.64	1,346.96	50,744.00
<u>Total</u>						
	Total	396,124.81	57,885.21	9,347.22	7,580.06	470,937.30

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,644 buildings will be at least moderately damaged. This is over 20% of the total number of buildings in the region. There are an estimated 176 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	13	40.85	10	31.02	5	16.94	3	9.18	1	2.02
Commercial	206	44.03	125	26.85	99	21.27	36	7.78	0	0.07
Education	10	47.71	6	26.34	4	19.57	1	6.38	0	0.00
Government	5	47.17	3	25.44	2	20.40	1	7.00	0	0.00
Industrial	71	45.50	38	24.32	33	20.90	14	8.87	1	0.41
Religion	14	43.87	10	30.77	6	19.18	2	6.18	0	0.01
Residential	3,224	43.77	2,706	36.74	1,029	13.97	233	3.16	174	2.37
Total	3,542		2,897		1,179		290		176	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	36	42.75	20	24.05	21	25.12	7	8.08	0	0.00
Masonry	264	42.94	168	27.36	139	22.63	38	6.24	5	0.84
MH	9	89.57	1	5.26	0	3.95	0	0.33	0	0.89
Steel	152	45.36	75	22.30	74	22.01	34	10.21	0	0.11
Wood	3,091	43.93	2,632	37.41	942	13.38	211	3.00	161	2.29

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	2	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 119,149 tons of debris will be generated. Of the total amount, 72,805 tons (61%) is Other Tree Debris. Of the remaining 46,344 tons, Brick/Wood comprises 38% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 715 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 28,471 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 264 households to be displaced due to the hurricane. Of these, 51 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 245.2 million dollars, which represents 12.09 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 245 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	133,879.94	14,018.77	2,420.28	2,075.23	152,394.22
	Content	57,736.09	6,673.10	1,702.86	955.85	67,067.90
	Inventory	0.00	120.36	221.48	15.65	357.49
	Subtotal	191,616.03	20,812.24	4,344.62	3,046.73	219,819.62
<u>Business Interruption Loss</u>						
	Income	15.41	1,510.83	24.88	56.54	1,607.66
	Relocation	12,854.45	2,637.27	223.20	406.11	16,121.01
	Rental	4,138.92	1,560.63	27.63	32.47	5,759.64
	Wage	36.29	1,443.85	41.34	407.45	1,928.94
	Subtotal	17,045.07	7,152.57	317.05	902.57	25,417.26
<u>Total</u>						
	Total	208,661.10	27,964.81	4,661.67	3,949.30	245,236.87

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 502 buildings will be at least moderately damaged. This is over 6% of the total number of buildings in the region. There are an estimated 30 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	21	69.29	6	19.78	2	6.94	1	3.47	0	0.52
Commercial	337	72.25	85	18.13	38	8.05	7	1.56	0	0.01
Education	16	76.39	3	16.50	1	6.14	0	0.97	0	0.00
Government	8	76.17	2	16.26	1	6.50	0	1.06	0	0.00
Industrial	115	74.00	26	16.45	12	7.56	3	1.90	0	0.10
Religion	23	71.96	6	20.22	2	6.79	0	1.03	0	0.00
Residential	5,174	70.23	1,759	23.88	366	4.97	39	0.53	29	0.40
Total	5,695		1,887		422		51		30	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	61	71.66	15	17.77	8	9.26	1	1.31	0	0.00
Masonry	432	70.33	118	19.28	55	9.04	7	1.21	1	0.15
MH	10	97.81	0	1.54	0	0.58	0	0.01	0	0.06
Steel	247	73.76	52	15.64	28	8.41	7	2.17	0	0.02
Wood	4,960	70.49	1,690	24.01	325	4.62	35	0.50	27	0.39

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 42,226 tons of debris will be generated. Of the total amount, 24,773 tons (59%) is Other Tree Debris. Of the remaining 17,453 tons, Brick/Wood comprises 34% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 238 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 11,491 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 50 households to be displaced due to the hurricane. Of these, 10 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 77.4 million dollars, which represents 3.81 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 77 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 87% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	45,483.28	4,181.68	663.20	607.39	50,935.55
	Content	17,565.16	1,498.59	403.36	206.63	19,673.74
	Inventory	0.00	28.01	54.81	4.99	87.81
	Subtotal	63,048.44	5,708.28	1,121.36	819.01	70,697.10
<u>Business Interruption Loss</u>						
	Income	0.37	350.02	7.43	44.81	402.62
	Relocation	3,096.57	811.06	64.65	120.65	4,092.93
	Rental	1,063.49	468.74	7.92	9.36	1,549.52
	Wage	0.87	306.52	12.43	316.36	636.19
	Subtotal	4,161.31	1,936.34	92.44	491.17	6,681.26
<u>Total</u>						
	Total	67,209.75	7,644.63	1,213.80	1,310.18	77,378.36

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 108 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	27	87.28	3	9.48	1	2.16	0	0.98	0	0.09
Commercial	418	89.42	40	8.56	9	1.84	1	0.19	0	0.00
Education	19	91.35	2	7.52	0	1.08	0	0.05	0	0.00
Government	9	91.25	1	7.54	0	1.16	0	0.05	0	0.00
Industrial	141	90.29	12	7.85	2	1.58	0	0.26	0	0.01
Religion	29	89.61	3	9.12	0	1.21	0	0.07	0	0.00
Residential	6,419	87.14	854	11.59	89	1.20	3	0.04	2	0.03
Total	7,062		914		101		5		2	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	76	89.30	8	8.88	1	1.76	0	0.06	0	0.00
Masonry	537	87.52	60	9.85	15	2.46	1	0.15	0	0.02
MH	10	99.58	0	0.33	0	0.08	0	0.00	0	0.00
Steel	303	90.33	25	7.52	6	1.88	1	0.28	0	0.00
Wood	6,147	87.35	810	11.51	75	1.07	3	0.04	2	0.03

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 22,618 tons of debris will be generated. Of the total amount, 14,107 tons (62%) is Other Tree Debris. Of the remaining 8,511 tons, Brick/Wood comprises 24% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 81 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 6,483 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 8 households to be displaced due to the hurricane. Of these, 1 person (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 26.4 million dollars, which represents 1.30 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 26 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 90% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	17,431.89	1,099.08	149.76	161.68	18,842.41
	Content	5,614.25	243.07	65.42	31.65	5,954.38
	Inventory	0.00	4.45	9.38	1.12	14.95
	Subtotal	23,046.13	1,346.60	224.56	194.45	24,811.74
<u>Business Interruption Loss</u>						
	Income	0.00	188.07	2.19	18.70	208.96
	Relocation	512.51	189.55	12.39	21.80	736.24
	Rental	222.65	113.10	1.74	1.66	339.16
	Wage	0.00	149.75	3.62	101.23	254.59
	Subtotal	735.16	640.47	19.94	143.38	1,538.95
<u>Total</u>						
	Total	23,781.29	1,987.07	244.51	337.83	26,350.70

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 11 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30	97.08	1	2.47	0	0.33	0	0.11	0	0.00
Commercial	455	97.40	11	2.35	1	0.23	0	0.01	0	0.00
Education	21	97.88	0	2.04	0	0.08	0	0.00	0	0.00
Government	10	97.83	0	2.11	0	0.07	0	0.00	0	0.00
Industrial	152	97.63	3	2.22	0	0.14	0	0.02	0	0.00
Religion	31	97.63	1	2.27	0	0.09	0	0.01	0	0.00
Residential	7,149	97.04	208	2.83	9	0.13	0	0.00	0	0.00
Total	7,848		225		11		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	83	97.25	2	2.64	0	0.11	0	0.00	0	0.00
Masonry	593	96.62	18	2.98	2	0.38	0	0.02	0	0.00
MH	10	99.98	0	0.01	0	0.00	0	0.00	0	0.00
Steel	327	97.59	7	2.18	1	0.21	0	0.02	0	0.00
Wood	6,837	97.15	193	2.74	7	0.10	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	11

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 12,754 tons of debris will be generated. Of the total amount, 8,549 tons (67%) is Other Tree Debris. Of the remaining 4,205 tons, Brick/Wood comprises 14% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 23 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 3,631 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 10.0 million dollars, which represents 0.49 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 10 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 95% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	7,035.14	279.08	28.96	36.86	7,380.05
	Content	2,138.62	40.31	6.01	4.57	2,189.51
	Inventory	0.00	0.69	0.92	0.13	1.75
	Subtotal	9,173.77	320.08	35.89	41.57	9,571.31
<u>Business Interruption Loss</u>						
	Income	0.00	31.52	0.07	4.33	35.93
	Relocation	190.48	32.26	0.71	3.14	226.60
	Rental	86.90	20.29	0.07	0.28	107.54
	Wage	0.00	29.92	0.12	10.18	40.22
	Subtotal	277.38	113.99	0.97	17.94	410.28
<u>Total</u>						
	Total	9,451.15	434.07	36.86	59.51	9,981.59

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

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There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	31	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Commercial	465	99.65	2	0.35	0	0.00	0	0.00	0	0.00
Education	21	99.67	0	0.33	0	0.00	0	0.00	0	0.00
Government	10	99.64	0	0.36	0	0.00	0	0.00	0	0.00
Industrial	155	99.65	1	0.35	0	0.00	0	0.00	0	0.00
Religion	32	99.71	0	0.29	0	0.01	0	0.00	0	0.00
Residential	7,362	99.94	5	0.06	0	0.00	0	0.00	0	0.00
Total	8,077		7		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	85	99.56	0	0.44	0	0.00	0	0.00	0	0.00
Masonry	612	99.61	2	0.38	0	0.01	0	0.00	0	0.00
MH	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	334	99.62	1	0.37	0	0.00	0	0.00	0	0.00
Wood	7,034	99.96	3	0.04	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	11

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 479 tons of debris will be generated. Of the total amount, 208 tons (43%) is Other Tree Debris. Of the remaining 271 tons, Brick/Wood comprises 17% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 226 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 1.1 million dollars, which represents 0.05 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 95% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	717.40	37.77	5.28	5.12	765.56
	Content	297.22	0.00	0.00	0.00	297.22
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	1,014.62	37.77	5.28	5.12	1,062.78
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.60	0.07	0.00	0.01	0.68
	Rental	0.83	0.00	0.00	0.00	0.83
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	1.43	0.07	0.00	0.01	1.51
<u>Total</u>						
	Total	1,016.05	37.84	5.28	5.13	1,064.29

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Hazus-MH: Hurricane Event Report

Region Name: Madison Probabilistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 36.72 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,858 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,029 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,084 buildings in the region which have an aggregate total replacement value of 2,029 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,608,845	79.3%
Commercial	313,853	15.5%
Industrial	52,757	2.6%
Agricultural	3,852	0.2%
Religious	21,929	1.1%
Government	8,475	0.4%
Education	19,084	0.9%
Total	2,028,795	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 11 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	31	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	467	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	21	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	156	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	32	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	7,367	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	8,084		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	85	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	614	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	335	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	7,037	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	11	0	0	11

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 17,858) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	17,858	1,608,845	419,950	2,028,795
Total	17,858	1,608,845	419,950	2,028,795
Study Region Total	17,858	1,608,845	419,950	2,028,795

Debris Summary Report: 10 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	45	0	226	208	479
Total	45	0	226	208	479
Study Region Total	45	0	226	208	479

Debris Summary Report: 50 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	574	0	3,631	8,549	12,754
Total	574	0	3,631	8,549	12,754
Study Region Total	574	0	3,631	8,549	12,754

Debris Summary Report: 100 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	2,026	2	6,483	14,107	22,618
Total	2,026	2	6,483	14,107	22,618
Study Region Total	2,026	2	6,483	14,107	22,618

Debris Summary Report: 200 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	5,913	49	11,491	24,773	42,226
Total	5,913	49	11,491	24,773	42,226
Study Region Total	5,913	49	11,491	24,773	42,226

Debris Summary Report: 500 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	17,668	205	28,471	72,805	119,149
Total	17,668	205	28,471	72,805	119,149
Study Region Total	17,668	205	28,471	72,805	119,149

Debris Summary Report: 1000 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	33,149	457	38,281	98,626	170,513
Total	33,149	457	38,281	98,626	170,513
Study Region Total	33,149	457	38,281	98,626	170,513

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

718

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,309	550	3	0.06	107	17	20	40	2,046
Total	1,309	550	3	0.06	107	17	20	40	2,046
Study Region Total	1,309	550	3	0.06	107	17	20	40	2,046

Direct Economic Losses For Buildings: 10 - year Event

719

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

720

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	766	297	0	0.04	1	0	0	1	1,064
Total	766	297	0	0.04	1	0	0	1	1,064
Study Region Total	766	297	0	0.04	1	0	0	1	1,064

Direct Economic Losses For Buildings: 50 - year Event

721

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,380	2,190	2	0.36	227	36	40	108	9,982
Total	7,380	2,190	2	0.36	227	36	40	108	9,982
Study Region Total	7,380	2,190	2	0.36	227	36	40	108	9,982

Direct Economic Losses For Buildings: 100 - year Event

722

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	18,842	5,954	15	0.93	736	209	255	339	26,351
Total	18,842	5,954	15	0.93	736	209	255	339	26,351
Study Region Total	18,842	5,954	15	0.93	736	209	255	339	26,351

Direct Economic Losses For Buildings: 200 - year Event

723

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	50,936	19,674	88	2.51	4,093	403	636	1,550	77,378
Total	50,936	19,674	88	2.51	4,093	403	636	1,550	77,378
Study Region Total	50,936	19,674	88	2.51	4,093	403	636	1,550	77,378

Direct Economic Losses For Buildings: 500 - year Event

724

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	152,394	67,068	357	7.51	16,121	1,608	1,929	5,760	245,237
Total	152,394	67,068	357	7.51	16,121	1,608	1,929	5,760	245,237
Study Region Total	152,394	67,068	357	7.51	16,121	1,608	1,929	5,760	245,237

Direct Economic Losses For Buildings: 1000 - year Event

725

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	286,643	132,822	729	14.13	30,057	4,782	5,150	10,755	470,937
Total	286,643	132,822	729	14.13	30,057	4,782	5,150	10,755	470,937
Study Region Total	286,643	132,822	729	14.13	30,057	4,782	5,150	10,755	470,937

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Madison Probabilistic-Annualized
Scenario : Probabilistic

Hazus-MH: Earthquake Event Report

Region Name: North Branford_EQ

Earthquake Scenario: Branford_Annualized

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 26.61 square miles and contains 2 census tracts. There are over 5 thousand households in the region which has a total population of 13,906 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 (millions of dollars). Approximately 91.00 % of the buildings (and 79.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 379 and 38 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 5 thousand buildings in the region which have an aggregate total replacement value of 1,186 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 6 schools, 0 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 417.00 (millions of dollars). This inventory includes over 52 kilometers of highways, 11 bridges, 396 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	11	24.30
	Segments	11	348.30
	Tunnels	0	0.00
	Subtotal		372.60
Railways	Bridges	1	0.00
	Facilities	0	0.00
	Segments	1	6.80
	Tunnels	0	0.00
	Subtotal		6.80
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			379.40

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.00
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		42.30
Waste Water	Distribution Lines	NA	2.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.40
Natural Gas	Distribution Lines	NA	1.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.60
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			46.20

Earthquake Scenario

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

Scenario Name	Branford_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	22	0.43	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	187	3.69	0	0.00	0	0.00	0	0.00	0	0.00
Education	1	0.02	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
Industrial	79	1.56	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	458	9.03	0	0.00	0	0.00	0	0.00	0	0.00
Religion	8	0.16	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	4,316	85.11	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,071		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,517	89.08	0	0.00	0	0.00	0	0.00	0	0.00
Steel	145	2.86	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	10	0.20	0	0.00	0	0.00	0	0.00	0	0.00
Precast	1	0.02	0	0.00	0	0.00	0	0.00	0	0.00
RM	36	0.71	0	0.00	0	0.00	0	0.00	0	0.00
URM	337	6.65	0	0.00	0	0.00	0	0.00	0	0.00
MH	25	0.49	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,071		0		0		0		0	

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	6	0	0	6
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	0	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	11	0	0	11	11
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	1	0	0	1	1
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	198	0	0
Waste Water	119	0	0
Natural Gas	79	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	5,132	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 4 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 78 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	348.30	\$0.00	0.00
	Bridges	24.28	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	372.60	0.00	
Railways	Segments	6.81	\$0.00	0.00
	Bridges	0.04	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	6.80	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	379.40	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	4.00	\$0.00	0.00
	Subtotal	42.26	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.40	\$0.00	0.00
	Subtotal	2.38	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.60	\$0.00	0.00
	Subtotal	1.59	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	46.23	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	13,906	933	253	1,186
Total State		13,906	933	253	1,186
Total Region		13,906	933	253	1,186

Hazus-MH: Earthquake Event Report

Region Name: North Branford_EQ

Earthquake Scenario: North_Brandford_Probabilistic_MM_7_100yr

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 26.61 square miles and contains 2 census tracts. There are over 5 thousand households in the region which has a total population of 13,906 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 (millions of dollars). Approximately 91.00 % of the buildings (and 79.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 379 and 38 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 5 thousand buildings in the region which have an aggregate total replacement value of 1,186 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 6 schools, 0 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 417.00 (millions of dollars). This inventory includes over 52 kilometers of highways, 11 bridges, 396 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	11	24.30
	Segments	11	348.30
	Tunnels	0	0.00
	Subtotal		372.60
Railways	Bridges	1	0.00
	Facilities	0	0.00
	Segments	1	6.80
	Tunnels	0	0.00
	Subtotal		6.80
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			379.40

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.00
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		42.30
Waste Water	Distribution Lines	NA	2.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.40
Natural Gas	Distribution Lines	NA	1.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.60
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			46.20

Earthquake Scenario

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

Scenario Name	North_Brandford_Probabilistic_MM_7_100yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	35	0.65	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	297	5.56	0	0.00	0	0.00	0	0.00	0	0.00
Education	10	0.19	0	0.00	0	0.00	0	0.00	0	0.00
Government	5	0.09	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	136	2.54	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	525	9.82	0	0.00	0	0.00	0	0.00	0	0.00
Religion	18	0.34	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	4,319	80.80	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,345		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,550	85.13	0	0.00	0	0.00	0	0.00	0	0.00
Steel	243	4.54	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	49	0.92	0	0.00	0	0.00	0	0.00	0	0.00
Precast	14	0.27	0	0.00	0	0.00	0	0.00	0	0.00
RM	83	1.55	0	0.00	0	0.00	0	0.00	0	0.00
URM	378	7.07	0	0.00	0	0.00	0	0.00	0	0.00
MH	27	0.51	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,345		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	6	0	0	6
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	0	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	11	0	0	11	11
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	1	0	0	1	1
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	198	0	0
Waste Water	119	0	0
Natural Gas	79	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	5,132	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	348.30	\$0.00	0.00
	Bridges	24.28	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	372.60	0.00	
Railways	Segments	6.81	\$0.00	0.00
	Bridges	0.04	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	6.80	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	379.40	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	4.00	\$0.00	0.00
	Subtotal	42.26	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.40	\$0.00	0.00
	Subtotal	2.38	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.60	\$0.00	0.00
	Subtotal	1.59	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	46.23	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	13,906	933	253	1,186
Total State		13,906	933	253	1,186
Total Region		13,906	933	253	1,186

Hazus-MH: Flood Event Report

Region Name: North Branford 100 year Riverine

Flood Scenario: Riverine 100 year

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 25 square miles and contains 232 census blocks. The region contains over 5 thousand households and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,345 buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 90.63% of the buildings (and 78.66% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 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	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religion	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	609,715	76.6%
Commercial	103,217	13.0%
Industrial	66,031	8.3%
Agricultural	4,864	0.6%
Religion	2,741	0.3%
Government	2,373	0.3%
Education	7,489	0.9%
Total	796,430	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police station and 1 emergency operation center.

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:	North Branford 100 year Riverine
Scenario Name:	Riverine 100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 37 buildings will be at least moderately damaged. This is over 25% of the total number of buildings in the scenario. There are an estimated 13 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	2	5.41	7	18.92	15	40.54	13	35.14
Total	0		0		2		7		15		13	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	2	5.41	7	18.92	15	40.54	13	35.14

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	0	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	6	0	0	0

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.

The model estimates that a total of 1,605 tons of debris will be generated. Of the total amount, Finishes comprises 49% of the total, Structure comprises 30% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 64 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 341 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 585 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 34.98 million dollars, which represents 4.39 % 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 34.89 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 44.42% 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	10.17	2.69	2.04	0.25	15.15
	Content	5.37	8.53	4.03	1.10	19.03
	Inventory	0.00	0.18	0.48	0.05	0.71
	Subtotal	15.54	11.40	6.55	1.40	34.89
<u>Business Interruption</u>						
	Income	0.00	0.02	0.00	0.00	0.02
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.04	0.07
	Subtotal	0.01	0.05	0.00	0.04	0.10
ALL	Total	15.54	11.45	6.55	1.45	34.98

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Total Study Region	13,906	933,100	253,150	1,186,250

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 100 year Riverine
Scenario: Riverine 100 year
Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$6.13	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.13
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$6.13	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.13
Total	\$6.13	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.13
Scenario Total	\$6.13	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.13

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 100 year Riverine
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	15,148	19,027	712	1.90	9	19	67	1	34,983
Total	15,148	19,027	712	1.90	9	19	67	1	34,983
Scenario Total	15,148	19,027	712	1.90	9	19	67	1	34,983

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 100 year Riverine
Scenario: Riverine 100 year
Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	210,099.15	280,132.20	280,132.20	280,132.20
Total	0.00	210,099.15	280,132.20	280,132.20	280,132.20
Total	0.00	210,099.15	280,132.20	280,132.20	280,132.20
Scenario Total	0.00	210,099.15	280,132.20	280,132.20	280,132.20

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 100 year Riverine
Scenario: Riverine 100 year
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	15,148	19,027	712	1.9	9	19	67	1	34,983
Total	15,148	19,027	712	1.9	9	19	67	1	34,983
Scenario Total	15,148	19,027	712	1.9	9	19	67	1	34,983

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 100 year Riverine
 Scenario: Riverine 100 year
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: North Branford 500 year Riverine

Flood Scenario: 500 year Riverine

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 25 square miles and contains 232 census blocks. The region contains over 5 thousand households and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,345 buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 90.63% of the buildings (and 78.66% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 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	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religion	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	546,264	78.4%
Commercial	81,268	11.7%
Industrial	53,782	7.7%
Agricultural	4,088	0.6%
Religion	2,624	0.4%
Government	1,628	0.2%
Education	7,487	1.1%
Total	697,141	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police station and 1 emergency operation center.

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:	North Branford 500 year Riverine
Scenario Name:	500 year Riverine
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	0	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	6	0	0	0

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.

The model estimates that a total of 19 tons of debris will be generated. Of the total amount, Finishes comprises 84% of the total, Structure comprises 8% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 51 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 15 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.52 million dollars, which represents 0.07 % 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 0.51 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 44.96% 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	0.15	0.01	0.05	0.00	0.21
	Content	0.09	0.08	0.12	0.01	0.30
	Inventory	0.00	0.00	0.01	0.00	0.01
	Subtotal	0.23	0.10	0.17	0.01	0.51
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
ALL	Total	0.23	0.10	0.17	0.01	0.52

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Total Study Region	13,906	933,100	253,150	1,186,250

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	53,880.93	71,841.23	71,841.23	71,841.23
Total	0.00	53,880.93	71,841.23	71,841.23	71,841.23
Total	0.00	53,880.93	71,841.23	71,841.23	71,841.23
Scenario Total	0.00	53,880.93	71,841.23	71,841.23	71,841.23

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: North Branford 500 year Riverine
Scenario: 500 year Riverine
Return Period: 500

Hazus-MH: Hurricane Event Report

Region Name: North Branford 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name: UN-NAMED-1938-4
Type: Historic
Max Peak Gust in Study Region: 115 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 581 buildings will be at least moderately damaged. This is over 11% of the total number of buildings in the region. There are an estimated 34 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	20	57.72	9	25.93	4	10.38	2	5.14	0	0.83
Commercial	187	62.94	68	22.73	34	11.55	8	2.75	0	0.03
Education	6	64.48	2	22.87	1	10.92	0	1.73	0	0.00
Government	3	64.53	1	22.43	1	11.26	0	1.78	0	0.00
Industrial	86	63.37	29	21.30	16	11.86	4	3.26	0	0.21
Religion	11	63.35	5	25.64	2	9.67	0	1.35	0	0.00
Residential	2,843	58.69	1,493	30.82	427	8.82	48	0.99	33	0.68
Total	3,157		1,606		485		63		34	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	39	63.06	14	22.18	8	12.97	1	1.79	0	0.00
Masonry	258	55.74	108	23.48	84	18.18	10	2.25	2	0.36
MH	23	92.41	1	4.14	1	2.68	0	0.15	0	0.62
Steel	157	64.46	47	19.54	30	12.19	9	3.74	0	0.07
Wood	2,705	59.46	1,429	31.42	340	7.48	44	0.96	31	0.68

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 43,733 tons of debris will be generated. Of the total amount, 27,931 tons (64%) is Other Tree Debris. Of the remaining 15,802 tons, Brick/Wood comprises 38% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 241 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 9,778 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 81 households to be displaced due to the hurricane. Of these, 16 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 64.5 million dollars, which represents 5.43 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 64 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	38,393.54	2,547.49	1,766.83	622.53	43,330.39
	Content	11,990.59	958.09	1,214.63	244.84	14,408.15
	Inventory	0.00	27.00	152.72	12.88	192.61
	Subtotal	50,384.13	3,532.59	3,134.18	880.25	57,931.16
<u>Business Interruption Loss</u>						
	Income	0.00	153.04	17.47	29.25	199.76
	Relocation	3,544.66	505.05	180.50	126.61	4,356.81
	Rental	1,320.77	279.44	25.93	8.35	1,634.49
	Wage	0.00	177.19	27.32	141.79	346.30
	Subtotal	4,865.42	1,114.72	251.22	306.00	6,537.35
<u>Total</u>						
	Total	55,249.56	4,647.31	3,385.40	1,186.25	64,468.51

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	5,980	44	9,778	27,931	43,733
Total	5,980	44	9,778	27,931	43,733
Study Region Total	5,980	44	9,778	27,931	43,733

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

804

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	43,330	14,408	193	3.65	4,357	200	346	1,634	64,469
Total	43,330	14,408	193	3.65	4,357	200	346	1,634	64,469
Study Region Total	43,330	14,408	193	3.65	4,357	200	346	1,634	64,469

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : North Branford 1938
 Scenario : UN-NAMED-1938-4

January 31, 2013

Study Region : North Branford Probabilistic-Annualized

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	27
Number of Census Tracts	2
Number of People in the Region	13,906
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	4,844	933,100
Commercial	297	139,409
Other	204	113,741
Total	5,345	1,186,250

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	3	0	0	0	3
50	92	7	0	0	99
100	406	49	1	0	456
200	989	194	10	7	1,201
500	1,696	601	96	67	2,460
1000	1,871	976	262	200	3,309

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	4	0	0	0	4
50	99	8	0	0	107
100	434	54	2	0	489
200	1,062	218	15	7	1,302
500	1,825	686	122	68	2,701
1000	2,006	1,110	329	203	3,648

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	6	1
200	29	6
500	148	30
1000	424	85

Economic Loss (x 1000)

ReturnPeriod	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	110	125	0
50	2,808	2,930	119
100	7,858	8,522	558
200	22,264	25,147	2,562
500	79,436	91,835	10,576
1000	167,958	197,148	23,218
Annualized	706	814	84

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,643 buildings will be at least moderately damaged. This is over 31% of the total number of buildings in the region. There are an estimated 203 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	10	28.57	12	33.19	8	22.21	5	12.88	1	3.15
Commercial	96	32.49	80	27.08	81	27.13	39	13.11	1	0.20
Education	3	34.03	3	27.05	3	27.03	1	11.88	0	0.01
Government	2	33.31	1	25.75	1	28.01	1	12.93	0	0.00
Industrial	45	32.92	33	24.10	37	27.34	20	14.74	1	0.91
Religion	6	33.01	6	32.43	5	25.06	2	9.51	0	0.01
Residential	1,535	31.68	1,871	38.62	976	20.14	262	5.42	200	4.14
Total	1,697		2,006		1,110		329		203	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	20	32.21	15	23.66	19	31.04	8	13.09	0	0.00
Masonry	133	28.70	117	25.32	156	33.80	48	10.41	8	1.77
MH	20	79.12	2	7.07	2	8.57	0	1.34	1	3.89
Steel	82	33.85	52	21.50	67	27.54	41	16.70	1	0.41
Wood	1,457	32.02	1,824	40.09	844	18.56	238	5.24	186	4.08

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	6	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 89,470 tons of debris will be generated. Of the total amount, 53,003 tons (59%) is Other Tree Debris. Of the remaining 36,467 tons, Brick/Wood comprises 48% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 712 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 18,655 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 424 households to be displaced due to the hurricane. Of these, 85 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 220.4 million dollars, which represents 18.58 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 220 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	118,973.67	9,238.27	6,317.70	2,116.10	136,645.75
	Content	48,983.99	4,701.03	5,005.79	1,053.19	59,744.00
	Inventory	0.00	119.48	599.46	39.47	758.40
	Subtotal	167,957.66	14,058.78	11,922.96	3,208.76	197,148.16
<u>Business Interruption Loss</u>						
	Income	0.00	1,005.30	82.02	45.92	1,133.24
	Relocation	12,508.31	1,740.48	568.17	417.03	15,233.99
	Rental	4,284.33	1,037.78	89.32	30.09	5,441.51
	Wage	0.00	1,105.19	130.52	173.23	1,408.95
	Subtotal	16,792.64	4,888.76	870.03	666.27	23,217.69
<u>Total</u>						
	Total	184,750.30	18,947.54	12,792.98	3,875.03	220,365.85

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 876 buildings will be at least moderately damaged. This is over 16% of the total number of buildings in the region. There are an estimated 68 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	17	47.47	10	29.70	5	14.22	3	7.20	0	1.41
Commercial	154	51.97	77	25.81	51	17.09	15	5.07	0	0.06
Education	5	54.38	3	25.76	2	16.18	0	3.68	0	0.00
Government	3	53.29	1	25.29	1	17.34	0	4.08	0	0.00
Industrial	71	52.44	32	23.80	24	17.50	8	5.87	1	0.38
Religion	10	52.89	5	29.46	3	14.68	1	2.98	0	0.00
Residential	2,384	49.22	1,696	35.02	601	12.41	96	1.97	67	1.38
Total	2,644		1,825		686		122		68	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	32	51.85	15	24.37	12	19.69	3	4.10	0	0.00
Masonry	212	45.85	117	25.42	111	24.01	19	4.04	3	0.68
MH	22	88.15	1	5.53	1	4.50	0	0.43	0	1.38
Steel	130	53.45	53	21.76	44	17.93	16	6.72	0	0.14
Wood	2,269	49.89	1,636	35.96	494	10.86	87	1.91	62	1.37

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 62,825 tons of debris will be generated. Of the total amount, 39,708 tons (63%) is Other Tree Debris. Of the remaining 23,117 tons, Brick/Wood comprises 38% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 356 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 14,214 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 148 households to be displaced due to the hurricane. Of these, 30 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 102.4 million dollars, which represents 8.63 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 102 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	58,342.58	4,088.28	2,837.58	960.45	66,228.88
	Content	21,093.53	1,730.30	2,051.53	409.03	25,284.38
	Inventory	0.00	47.07	254.90	19.30	321.27
	Subtotal	79,436.11	5,865.65	5,144.00	1,388.78	91,834.53
<u>Business Interruption Loss</u>						
	Income	0.00	214.27	28.07	25.80	268.15
	Relocation	5,983.93	818.18	281.61	192.18	7,275.90
	Rental	2,130.58	460.41	40.03	12.92	2,643.93
	Wage	0.00	235.28	44.16	108.52	387.96
	Subtotal	8,114.51	1,728.14	393.87	339.42	10,575.94
<u>Total</u>						
	Total	87,550.61	7,593.78	5,537.87	1,728.20	102,410.47

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 240 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	27	75.93	6	16.68	2	4.80	1	2.31	0	0.28
Commercial	237	79.68	44	14.70	14	4.72	3	0.89	0	0.01
Education	8	82.72	1	13.72	0	3.32	0	0.24	0	0.00
Government	4	81.27	1	14.45	0	3.98	0	0.30	0	0.00
Industrial	109	80.30	19	13.93	6	4.64	1	1.05	0	0.08
Religion	15	80.63	3	15.89	1	3.26	0	0.23	0	0.00
Residential	3,643	75.22	989	20.41	194	4.02	10	0.22	7	0.15
Total	4,043		1,062		218		15		7	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	50	80.13	9	14.78	3	4.79	0	0.29	0	0.00
Masonry	335	72.45	77	16.75	46	9.93	4	0.76	0	0.11
MH	24	96.49	1	2.23	0	1.05	0	0.03	0	0.20
Steel	197	81.13	31	12.72	12	4.93	3	1.20	0	0.02
Wood	3,461	76.07	934	20.53	138	3.04	10	0.21	7	0.15

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 19,425 tons of debris will be generated. Of the total amount, 11,926 tons (61%) is Other Tree Debris. Of the remaining 7,499 tons, Brick/Wood comprises 39% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 119 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,535 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 29 households to be displaced due to the hurricane. Of these, 6 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 27.7 million dollars, which represents 2.34 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 28 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	18,221.46	1,077.94	697.52	242.47	20,239.39
	Content	4,043.01	304.00	414.38	74.59	4,835.98
	Inventory	0.00	9.21	57.26	4.99	71.45
	Subtotal	22,264.47	1,391.15	1,169.16	322.04	25,146.82
<u>Business Interruption Loss</u>						
	Income	0.00	152.60	10.57	24.76	187.93
	Relocation	1,124.19	213.80	65.57	48.20	1,451.75
	Rental	513.32	120.41	10.12	3.21	647.06
	Wage	0.00	158.13	16.47	100.63	275.22
	Subtotal	1,637.51	644.93	102.73	176.80	2,561.97
<u>Total</u>						
	Total	23,901.97	2,036.08	1,271.89	498.84	27,708.79

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 56 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	32	91.57	2	6.59	0	1.26	0	0.54	0	0.03
Commercial	277	93.32	16	5.54	3	0.99	0	0.14	0	0.00
Education	9	94.62	0	4.98	0	0.39	0	0.01	0	0.00
Government	5	94.12	0	5.39	0	0.48	0	0.01	0	0.00
Industrial	127	93.62	7	5.39	1	0.79	0	0.18	0	0.01
Religion	17	93.88	1	5.70	0	0.41	0	0.03	0	0.00
Residential	4,388	90.59	406	8.37	49	1.01	1	0.02	0	0.01
Total	4,856		434		54		2		0	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	58	93.55	4	5.81	0	0.63	0	0.01	0	0.00
Masonry	408	88.23	37	8.11	16	3.50	1	0.15	0	0.01
MH	25	99.42	0	0.45	0	0.12	0	0.00	0	0.01
Steel	228	94.01	12	4.84	2	0.97	0	0.18	0	0.00
Wood	4,151	91.26	371	8.15	26	0.56	1	0.02	0	0.01

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 10,698 tons of debris will be generated. Of the total amount, 7,095 tons (66%) is Other Tree Debris. Of the remaining 3,603 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 43 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,519 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 6 households to be displaced due to the hurricane. Of these, 1 person (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 9.1 million dollars, which represents 0.77 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 9 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	7,092.67	299.25	158.85	61.79	7,612.56
	Content	765.40	54.21	64.68	13.23	897.52
	Inventory	0.00	1.44	9.62	0.91	11.96
	Subtotal	7,858.07	354.90	233.16	75.93	8,522.05
<u>Business Interruption Loss</u>						
	Income	0.00	34.23	1.17	4.58	39.98
	Relocation	228.51	42.11	8.56	6.58	285.76
	Rental	161.73	23.29	1.22	0.40	186.64
	Wage	0.00	33.20	1.94	10.76	45.90
	Subtotal	390.23	132.83	12.89	22.33	558.29
<u>Total</u>						
	Total	8,248.30	487.73	246.05	98.25	9,080.34

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	34	98.17	1	1.61	0	0.17	0	0.04	0	0.00
Commercial	292	98.38	4	1.46	0	0.15	0	0.01	0	0.00
Education	10	98.53	0	1.44	0	0.03	0	0.00	0	0.00
Government	5	98.48	0	1.50	0	0.03	0	0.00	0	0.00
Industrial	134	98.41	2	1.51	0	0.07	0	0.01	0	0.00
Religion	18	98.62	0	1.34	0	0.04	0	0.00	0	0.00
Residential	4,745	97.96	92	1.89	7	0.15	0	0.00	0	0.00
Total	5,238		99		8		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	61	98.27	1	1.70	0	0.02	0	0.00	0	0.00
Masonry	445	96.43	13	2.88	3	0.68	0	0.01	0	0.00
MH	25	99.98	0	0.02	0	0.00	0	0.00	0	0.00
Steel	239	98.47	3	1.40	0	0.12	0	0.01	0	0.00
Wood	4,470	98.27	77	1.68	2	0.05	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3,962 tons of debris will be generated. Of the total amount, 2,675 tons (68%) is Other Tree Debris. Of the remaining 1,287 tons, Brick/Wood comprises 24% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 12 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 979 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 3.0 million dollars, which represents 0.26 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 3 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 96% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	2,662.33	72.70	28.76	12.89	2,776.67
	Content	145.54	4.33	2.18	0.66	152.72
	Inventory	0.00	0.11	0.47	0.08	0.65
	Subtotal	2,807.87	77.13	31.41	13.63	2,930.05
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	71.58	1.71	0.34	0.18	73.81
	Rental	44.89	0.00	0.00	0.00	44.89
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	116.47	1.71	0.34	0.18	118.70
<u>Total</u>						
	Total	2,924.34	78.85	31.75	13.80	3,048.75

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	933,100	78.7%
Commercial	139,409	11.8%
Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	35	99.80	0	0.20	0	0.00	0	0.00	0	0.00
Commercial	296	99.73	1	0.27	0	0.00	0	0.00	0	0.00
Education	10	99.72	0	0.28	0	0.00	0	0.00	0	0.00
Government	5	99.70	0	0.30	0	0.00	0	0.00	0	0.00
Industrial	136	99.71	0	0.29	0	0.00	0	0.00	0	0.00
Religion	18	99.77	0	0.23	0	0.00	0	0.00	0	0.00
Residential	4,841	99.94	3	0.06	0	0.00	0	0.00	0	0.00
Total	5,341		4		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	62	99.66	0	0.34	0	0.00	0	0.00	0	0.00
Masonry	460	99.57	2	0.42	0	0.01	0	0.00	0	0.00
MH	25	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	242	99.71	1	0.29	0	0.00	0	0.00	0	0.00
Wood	4,548	99.98	1	0.02	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 7 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 7 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.1 million dollars, which represents 0.01 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 88% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	108.73	9.34	4.90	1.16	124.14
	Content	1.25	0.00	0.00	0.00	1.25
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	109.98	9.34	4.90	1.16	125.39
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.13	0.00	0.00	0.00	0.13
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.13	0.00	0.00	0.00	0.13
<u>Total</u>						
	Total	110.11	9.34	4.90	1.16	125.52

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Hazus-MH: Hurricane Event Report

Region Name: North Branford Probablistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

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Note:

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

The geographical size of the region is 26.62 square miles and contains 2 census tracts. There are over 5 thousand households in the region and has a total population of 13,906 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,186 million dollars (2006 dollars). Approximately 91% of the buildings (and 79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,345 buildings in the region which have an aggregate total replacement value of 1,186 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

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Industrial	81,711	6.9%
Agricultural	6,604	0.6%
Religious	7,228	0.6%
Government	2,828	0.2%
Education	15,370	1.3%
Total	1,186,250	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 6 schools, no fire stations, 1 police stations and 1 emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	35	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	297	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	5	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	136	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	18	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	4,844	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,345		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	62	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	462	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	25	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	243	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	4,549	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	1	0	0	1
Police Stations	1	0	0	1
Schools	6	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,906) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,906	933,100	253,150	1,186,250
Total	13,906	933,100	253,150	1,186,250
Study Region Total	13,906	933,100	253,150	1,186,250

Debris Summary Report: 10 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	7	0	0	0	7
Total	7	0	0	0	7
Study Region Total	7	0	0	0	7

Debris Summary Report: 50 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	308	0	979	2,675	3,962
Total	308	0	979	2,675	3,962
Study Region Total	308	0	979	2,675	3,962

Debris Summary Report: 100 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1,084	0	2,519	7,095	10,698
Total	1,084	0	2,519	7,095	10,698
Study Region Total	1,084	0	2,519	7,095	10,698

Debris Summary Report: 200 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	2,958	6	4,535	11,926	19,425
Total	2,958	6	4,535	11,926	19,425
Study Region Total	2,958	6	4,535	11,926	19,425

Debris Summary Report: 500 - year Event
January 31, 2013
All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	8,817	86	14,214	39,708	62,825
Total	8,817	86	14,214	39,708	62,825
Study Region Total	8,817	86	14,214	39,708	62,825

Debris Summary Report: 1000 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	17,589	223	18,655	53,003	89,470
Total	17,589	223	18,655	53,003	89,470
Study Region Total	17,589	223	18,655	53,003	89,470

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

890

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	599	212	3	0.05	53	5	6	20	898
Total	599	212	3	0.05	53	5	6	20	898
Study Region Total	599	212	3	0.05	53	5	6	20	898

Direct Economic Losses For Buildings: 10 - year Event

891

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

892

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	124	1	0	0.01	0	0	0	0	126
Total	124	1	0	0.01	0	0	0	0	126
Study Region Total	124	1	0	0.01	0	0	0	0	126

Direct Economic Losses For Buildings: 50 - year Event

893

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	2,777	153	1	0.23	74	0	0	45	3,049
Total	2,777	153	1	0.23	74	0	0	45	3,049
Study Region Total	2,777	153	1	0.23	74	0	0	45	3,049

Direct Economic Losses For Buildings: 100 - year Event

894

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,613	898	12	0.64	286	40	46	187	9,080
Total	7,613	898	12	0.64	286	40	46	187	9,080
Study Region Total	7,613	898	12	0.64	286	40	46	187	9,080

Direct Economic Losses For Buildings: 200 - year Event

895

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	20,239	4,836	71	1.71	1,452	188	275	647	27,709
Total	20,239	4,836	71	1.71	1,452	188	275	647	27,709
Study Region Total	20,239	4,836	71	1.71	1,452	188	275	647	27,709

Direct Economic Losses For Buildings: 500 - year Event

896

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	66,229	25,284	321	5.58	7,276	268	388	2,644	102,410
Total	66,229	25,284	321	5.58	7,276	268	388	2,644	102,410
Study Region Total	66,229	25,284	321	5.58	7,276	268	388	2,644	102,410

Direct Economic Losses For Buildings: 1000 - year Event

897

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	136,646	59,744	758	11.52	15,234	1,133	1,409	5,442	220,366
Total	136,646	59,744	758	11.52	15,234	1,133	1,409	5,442	220,366
Study Region Total	136,646	59,744	758	11.52	15,234	1,133	1,409	5,442	220,366

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : North Branford Probabilistic-Annualized
Scenario : Probabilistic

Hazus-MH: Earthquake Event Report

Region Name: North Haven EQ

Earthquake Scenario: North Haven Annualized

Print Date: March 05, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 21.06 square miles and contains 4 census tracts. There are over 8 thousand households in the region which has a total population of 23,035 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 (millions of dollars). Approximately 90.00 % of the buildings (and 65.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,466 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 9 thousand buildings in the region which have an aggregate total replacement value of 2,581 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 86% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 9 schools, 4 fire stations, 0 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 23 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,542.00 (millions of dollars). This inventory includes over 63 kilometers of highways, 62 bridges, 544 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	62	937.80
	Segments	34	484.20
	Tunnels	0	0.00
	Subtotal		1,422.00
Railways	Bridges	0	0.00
	Facilities	1	2.70
	Segments	24	40.60
	Tunnels	0	0.00
	Subtotal		43.30
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			1,466.60

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.40
Waste Water	Distribution Lines	NA	3.30
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.90
Natural Gas	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			87.50

Earthquake Scenario

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

Scenario Name	North Haven Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	21	0.24	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	397	4.45	0	0.00	0	0.00	0	0.00	0	0.00
Education	2	0.02	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
Industrial	126	1.41	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	485	5.44	0	0.00	0	0.00	0	0.00	0	0.00
Religion	22	0.25	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	7,867	88.20	0	0.00	0	0.00	0	0.00	0	0.00
Total	8,920		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	8,035	90.08	0	0.00	0	0.00	0	0.00	0	0.00
Steel	267	2.99	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	10	0.11	0	0.00	0	0.00	0	0.00	0	0.00
Precast	2	0.02	0	0.00	0	0.00	0	0.00	0	0.00
RM	39	0.44	0	0.00	0	0.00	0	0.00	0	0.00
URM	567	6.36	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	8,920		0		0		0		0	

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	0	0	0	0
FireStations	4	0	0	4

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	34	0	0	34	34
	Bridges	62	0	0	62	62
	Tunnels	0	0	0	0	0
Railways	Segments	24	0	0	24	24
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	272	0	0
Waste Water	163	0	0
Natural Gas	109	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	8,597	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.01 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.01 (millions of dollars); 14 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 51 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.01
	Total	0.00	0.00	0.00	0.00	0.00	0.01

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	484.20	\$0.00	0.00
	Bridges	937.82	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	1422.00	0.00	
Railways	Segments	40.63	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	43.30	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.00
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	1466.60	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.40	\$0.00	0.00
	Subtotal	5.45	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	79.86	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.20	\$0.00	0.00
	Subtotal	2.18	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	87.48	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	23,035	1,680	900	2,581
Total State		23,035	1,680	900	2,581
Total Region		23,035	1,680	900	2,581

Hazus-MH: Earthquake Event Report

Region Name: North Haven EQ

Earthquake Scenario: North Haven 100 year Probabilistic

Print Date: March 05, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 21.06 square miles and contains 4 census tracts. There are over 8 thousand households in the region which has a total population of 23,035 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 (millions of dollars). Approximately 90.00 % of the buildings (and 65.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,466 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 9 thousand buildings in the region which have an aggregate total replacement value of 2,581 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 86% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 9 schools, 4 fire stations, 0 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 23 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,542.00 (millions of dollars). This inventory includes over 63 kilometers of highways, 62 bridges, 544 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	62	937.80
	Segments	34	484.20
	Tunnels	0	0.00
	Subtotal		1,422.00
Railways	Bridges	0	0.00
	Facilities	1	2.70
	Segments	24	40.60
	Tunnels	0	0.00
	Subtotal		43.30
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			1,466.60

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.40
Waste Water	Distribution Lines	NA	3.30
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.90
Natural Gas	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.20
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			87.50

Earthquake Scenario

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

Scenario Name	North Haven 100 year Probabilistic
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	44	0.46	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	627	6.62	0	0.00	0	0.00	0	0.00	0	0.00
Education	20	0.21	0	0.00	0	0.00	0	0.00	0	0.00
Government	8	0.08	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	240	2.54	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	606	6.40	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	0.46	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	7,876	83.21	0	0.00	0	0.00	0	0.00	0	0.00
Total	9,465		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	8,115	85.73	0	0.00	0	0.00	0	0.00	0	0.00
Steel	463	4.89	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	85	0.89	0	0.00	0	0.00	0	0.00	0	0.00
Precast	30	0.32	0	0.00	0	0.00	0	0.00	0	0.00
RM	130	1.38	0	0.00	0	0.00	0	0.00	0	0.00
URM	642	6.78	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	9,465		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	0	0	0	0
FireStations	4	0	0	4

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	34	0	0	34	34
	Bridges	62	0	0	62	62
	Tunnels	0	0	0	0	0
Railways	Segments	24	0	0	24	24
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	272	0	0
Waste Water	163	0	0
Natural Gas	109	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	8,597	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	484.20	\$0.00	0.00
	Bridges	937.82	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	1422.00	0.00	
Railways	Segments	40.63	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	43.30	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.00
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	1466.60	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.40	\$0.00	0.00
	Subtotal	5.45	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	79.86	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.20	\$0.00	0.00
	Subtotal	2.18	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	87.48	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	23,035	1,680	900	2,581
Total State		23,035	1,680	900	2,581
Total Region		23,035	1,680	900	2,581

Hazus-MH: Flood Event Report

Region Name: North Haven DG 500

Flood Scenario: 500 year

Print Date: Tuesday, March 05, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 21 square miles and contains 384 census blocks. The region contains over 9 thousand households and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,465 buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 89.61% of the buildings (and 65.10% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 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	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religion	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	362,790	50.8%
Commercial	188,465	26.4%
Industrial	150,977	21.1%
Agricultural	2,225	0.3%
Religion	6,582	0.9%
Government	0	0.0%
Education	3,477	0.5%
Total	714,516	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no 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:	North Haven DG 500
Scenario Name:	500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	4	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	9	0	0	0

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.

The model estimates that a total of 53 tons of debris will be generated. Of the total amount, Finishes comprises 44% of the total, Structure comprises 32% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 59 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 26 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 1.74 million dollars, which represents 0.24 % 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 1.73 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 10.18% 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	0.12	0.21	0.16	0.01	0.50
	Content	0.06	0.59	0.46	0.04	1.15
	Inventory	0.00	0.01	0.06	0.00	0.08
	Subtotal	0.18	0.82	0.68	0.05	1.73
<u>Business Interruption</u>						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.00	0.01
	Subtotal	0.00	0.01	0.00	0.00	0.01
ALL	Total	0.18	0.83	0.68	0.05	1.74

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Total Study Region	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Flood Event Report

Region Name: North Haven Depth Grid Flood

Flood Scenario: 100 year

Print Date: Tuesday, March 05, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 21 square miles and contains 384 census blocks. The region contains over 9 thousand households and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 9,465 buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 89.61% of the buildings (and 65.10% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 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	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religion	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	496,507	55.8%
Commercial	214,497	24.1%
Industrial	164,410	18.5%
Agricultural	2,153	0.2%
Religion	9,087	1.0%
Government	0	0.0%
Education	3,477	0.4%
Total	890,131	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no 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:	North Haven Depth Grid Flood
Scenario Name:	100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 25 buildings will be at least moderately damaged. This is over 26% of the total number of buildings in the scenario. There are an estimated 10 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	1	4.00	5	20.00	9	36.00	10	40.00
Total	0		0		1		5		9		10	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	1	4.00	5	20.00	9	36.00	10	40.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	4	0	0	0
Hospitals	0	0	0	0
Police Stations	0	0	0	0
Schools	9	0	0	0

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.

The model estimates that a total of 3,000 tons of debris will be generated. Of the total amount, Finishes comprises 30% of the total, Structure comprises 41% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 120 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 199 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 302 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 66.30 million dollars, which represents 7.45 % 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 66.10 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 15.36% 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	6.75	5.79	8.23	0.10	20.86
	Content	3.43	14.25	23.08	0.46	41.22
	Inventory	0.00	0.56	3.45	0.02	4.03
	Subtotal	10.18	20.60	34.76	0.57	66.10
<u>Business Interruption</u>						
	Income	0.00	0.08	0.01	0.00	0.08
	Relocation	0.01	0.02	0.00	0.00	0.03
	Rental Income	0.00	0.01	0.00	0.00	0.01
	Wage	0.00	0.07	0.00	0.00	0.07
	Subtotal	0.01	0.18	0.01	0.00	0.20
ALL	Total	10.18	20.77	34.77	0.57	66.30

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Total Study Region	23,035	1,680,305	900,919	2,581,224

Direct Economic Losses For Buildings: Annualized Losses

958

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,275	542	11	0.05	117	19	22	46	2,033
Total	1,275	542	11	0.05	117	19	22	46	2,033
Study Region Total	1,275	542	11	0.05	117	19	22	46	2,033

Direct Economic Losses For Buildings: 10 - year Event

959

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

960

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	313	114	0	0.01	0	0	0	0	428
Total	313	114	0	0.01	0	0	0	0	428
Study Region Total	313	114	0	0.01	0	0	0	0	428

Direct Economic Losses For Buildings: 50 - year Event

961

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	5,433	1,219	2	0.21	145	0	0	64	6,863
Total	5,433	1,219	2	0.21	145	0	0	64	6,863
Study Region Total	5,433	1,219	2	0.21	145	0	0	64	6,863

Direct Economic Losses For Buildings: 100 - year Event

962

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	16,246	4,057	48	0.63	765	254	311	398	22,077
Total	16,246	4,057	48	0.63	765	254	311	398	22,077
Study Region Total	16,246	4,057	48	0.63	765	254	311	398	22,077

Direct Economic Losses For Buildings: 200 - year Event

963

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	41,722	13,682	274	1.62	3,150	722	894	1,317	61,761
Total	41,722	13,682	274	1.62	3,150	722	894	1,317	61,761
Study Region Total	41,722	13,682	274	1.62	3,150	722	894	1,317	61,761

Direct Economic Losses For Buildings: 500 - year Event

964

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	138,676	59,574	1,304	5.37	15,884	1,059	1,387	5,926	223,810
Total	138,676	59,574	1,304	5.37	15,884	1,059	1,387	5,926	223,810
Study Region Total	138,676	59,574	1,304	5.37	15,884	1,059	1,387	5,926	223,810

Direct Economic Losses For Buildings: 1000 - year Event

965

March 5, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	309,522	148,540	3,267	11.99	35,498	4,668	5,421	13,466	520,382
Total	309,522	148,540	3,267	11.99	35,498	4,668	5,421	13,466	520,382
Study Region Total	309,522	148,540	3,267	11.99	35,498	4,668	5,421	13,466	520,382

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : North Haven 1938 Hurricane
 Scenario : Probabilistic

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 3,120 buildings will be at least moderately damaged. This is over 33% of the total number of buildings in the region. There are an estimated 438 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	12	26.86	14	32.63	10	22.87	6	14.01	2	3.63
Commercial	193	30.77	159	25.37	172	27.38	101	16.19	2	0.30
Education	6	31.61	5	26.01	6	27.68	3	14.69	0	0.01
Government	2	31.02	2	24.51	2	28.38	1	16.09	0	0.01
Industrial	74	30.70	55	23.08	66	27.47	42	17.48	3	1.27
Religion	14	31.01	14	31.68	11	25.79	5	11.51	0	0.02
Residential	2,565	30.24	3,230	38.08	1,739	20.50	517	6.10	431	5.09
Total	2,866		3,480		2,006		676		438	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	35	30.07	26	22.38	37	31.75	18	15.81	0	0.00
Masonry	220	28.55	185	24.00	242	31.43	108	14.02	15	1.99
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	147	31.60	93	20.07	128	27.59	94	20.29	2	0.44
Wood	2,476	30.52	3,219	39.68	1,569	19.34	460	5.67	388	4.78

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	9	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 88,820 tons of debris will be generated. Of the total amount, 25,344 tons (29%) is Other Tree Debris. Of the remaining 63,476 tons, Brick/Wood comprises 60% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1537 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 25,061 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 786 households to be displaced due to the hurricane. Of these, 160 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 520.4 million dollars, which represents 20.16 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 520 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 72% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	237,920.10	45,830.89	21,072.14	4,699.13	309,522.26
	Content	103,733.35	24,913.20	17,423.76	2,469.92	148,540.22
	Inventory	0.00	753.37	2,461.44	51.80	3,266.61
	Subtotal	341,653.44	71,497.45	40,957.35	7,220.85	461,329.09
<u>Business Interruption Loss</u>						
	Income	46.65	4,194.06	328.59	98.40	4,667.70
	Relocation	24,777.15	8,258.43	1,560.90	901.50	35,497.98
	Rental	8,147.07	4,958.72	277.69	82.55	13,466.04
	Wage	109.84	4,289.17	517.89	503.95	5,420.85
	Subtotal	33,080.71	21,700.39	2,685.07	1,586.40	59,052.57
<u>Total</u>						
	Total	374,734.16	93,197.84	43,642.42	8,807.25	520,381.66

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,557 buildings will be at least moderately damaged. This is over 16% of the total number of buildings in the region. There are an estimated 137 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	21	47.15	13	29.34	6	14.40	3	7.62	1	1.48
Commercial	324	51.69	153	24.43	110	17.54	39	6.25	0	0.08
Education	11	53.24	5	25.27	3	17.00	1	4.50	0	0.00
Government	4	51.87	2	24.65	1	18.27	0	5.20	0	0.00
Industrial	124	51.53	56	23.21	43	17.96	16	6.80	1	0.49
Religion	23	52.30	13	28.94	7	15.21	2	3.55	0	0.00
Residential	4,210	49.64	2,950	34.78	1,015	11.97	171	2.02	135	1.59
Total	4,717		3,192		1,186		233		137	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	59	51.10	27	23.65	24	20.42	6	4.83	0	0.00
Masonry	370	48.01	190	24.58	165	21.42	41	5.27	5	0.71
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	244	52.52	96	20.71	86	18.52	38	8.13	1	0.12
Wood	4,077	50.26	2,890	35.62	871	10.74	153	1.88	122	1.50

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 52,912 tons of debris will be generated. Of the total amount, 17,809 tons (34%) is Other Tree Debris. Of the remaining 35,103 tons, Brick/Wood comprises 50% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 703 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 17,517 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 233 households to be displaced due to the hurricane. Of these, 47 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 223.8 million dollars, which represents 8.67 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 224 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 74% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	108,576.35	19,013.73	9,079.28	2,006.92	138,676.27
	Content	43,068.48	8,754.47	6,868.60	882.12	59,573.67
	Inventory	0.00	280.11	999.57	24.11	1,303.79
	Subtotal	151,644.83	28,048.31	16,947.46	2,913.14	199,553.74
<u>Business Interruption Loss</u>						
	Income	2.55	883.63	109.43	63.01	1,058.62
	Relocation	11,021.48	3,709.15	752.30	401.32	15,884.25
	Rental	3,701.36	2,069.70	120.66	34.41	5,926.12
	Wage	6.01	843.86	170.05	367.52	1,387.43
	Subtotal	14,731.39	7,506.35	1,152.44	866.25	24,256.42
<u>Total</u>						
	Total	166,376.22	35,554.65	18,099.89	3,779.39	223,810.16

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 409 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 16 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	33	74.67	8	17.35	2	5.21	1	2.48	0	0.30
Commercial	493	78.67	92	14.71	34	5.47	7	1.13	0	0.01
Education	16	80.17	3	15.14	1	4.36	0	0.33	0	0.00
Government	6	79.80	1	15.13	0	4.71	0	0.36	0	0.00
Industrial	189	78.78	35	14.60	13	5.31	3	1.21	0	0.10
Religion	35	79.36	7	16.57	2	3.80	0	0.28	0	0.00
Residential	6,371	75.12	1,766	20.82	311	3.67	18	0.21	16	0.18
Total	7,144		1,912		364		29		16	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	91	78.77	18	15.44	6	5.46	0	0.33	0	0.00
Masonry	575	74.62	128	16.57	60	7.75	7	0.95	1	0.12
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	369	79.53	60	13.02	27	5.90	7	1.53	0	0.01
Wood	6,152	75.83	1,686	20.79	244	3.01	17	0.21	14	0.17

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 21,035 tons of debris will be generated. Of the total amount, 7,885 tons (37%) is Other Tree Debris. Of the remaining 13,150 tons, Brick/Wood comprises 42% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 222 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 7,601 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 38 households to be displaced due to the hurricane. Of these, 8 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 61.8 million dollars, which represents 2.39 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 62 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 77% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	34,269.43	4,777.02	2,164.01	511.60	41,722.06
	Content	10,675.92	1,494.20	1,357.87	153.92	13,681.91
	Inventory	0.00	51.99	215.50	6.40	273.89
	Subtotal	44,945.35	6,323.22	3,737.38	671.91	55,677.87
<u>Business Interruption Loss</u>						
	Income	0.00	627.97	34.38	60.02	722.37
	Relocation	1,898.59	969.85	181.91	99.63	3,149.98
	Rental	750.11	527.91	30.63	8.10	1,316.74
	Wage	0.00	516.67	52.30	325.17	894.13
	Subtotal	2,648.70	2,642.39	299.22	492.91	6,083.22
<u>Total</u>						
	Total	47,594.05	8,965.62	4,036.60	1,164.83	61,761.09

Appendix A: County Listing for the Region

Connecticut

- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 87 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	40	90.64	3	7.28	1	1.43	0	0.61	0	0.04
Commercial	581	92.62	37	5.90	8	1.28	1	0.20	0	0.00
Education	19	93.46	1	5.94	0	0.59	0	0.01	0	0.00
Government	7	93.24	0	6.11	0	0.64	0	0.02	0	0.00
Industrial	223	92.74	15	6.06	2	0.97	1	0.22	0	0.01
Religion	41	93.06	3	6.38	0	0.54	0	0.02	0	0.00
Residential	7,654	90.23	755	8.90	71	0.84	1	0.01	1	0.01
Total	8,564		814		82		3		1	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	108	92.79	7	6.43	1	0.77	0	0.01	0	0.00
Masonry	693	89.90	60	7.74	17	2.16	1	0.18	0	0.01
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	432	93.11	24	5.28	6	1.35	1	0.25	0	0.00
Wood	7,362	90.74	701	8.64	48	0.59	1	0.02	1	0.01

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 11,036 tons of debris will be generated. Of the total amount, 4,617 tons (42%) is Other Tree Debris. Of the remaining 6,419 tons, Brick/Wood comprises 31% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 79 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,448 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 6 households to be displaced due to the hurricane. Of these, 1 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 22.1 million dollars, which represents 0.86 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 22 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	14,220.05	1,371.25	512.97	141.54	16,245.80
	Content	3,547.71	262.79	220.19	26.61	4,057.30
	Inventory	0.00	8.33	37.92	1.30	47.55
	Subtotal	17,767.76	1,642.37	771.07	169.45	20,350.65
<u>Business Interruption Loss</u>						
	Income	0.00	225.22	6.64	21.87	253.73
	Relocation	449.79	264.63	27.87	22.55	764.84
	Rental	234.48	155.87	4.96	2.18	397.50
	Wage	0.00	193.29	9.89	107.53	310.71
	Subtotal	684.27	839.01	49.36	154.13	1,726.78
<u>Total</u>						
	Total	18,452.03	2,481.38	820.43	323.58	22,077.43

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	43	98.34	1	1.48	0	0.14	0	0.04	0	0.00
Commercial	618	98.49	8	1.35	1	0.16	0	0.01	0	0.00
Education	20	98.61	0	1.37	0	0.02	0	0.00	0	0.00
Government	8	98.52	0	1.46	0	0.02	0	0.00	0	0.00
Industrial	236	98.44	4	1.49	0	0.06	0	0.01	0	0.00
Religion	43	98.70	1	1.26	0	0.04	0	0.00	0	0.00
Residential	8,340	98.32	136	1.60	6	0.07	0	0.00	0	0.00
Total	9,308		149		8		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	114	98.35	2	1.63	0	0.02	0	0.00	0	0.00
Masonry	752	97.57	16	2.14	2	0.28	0	0.01	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	457	98.53	6	1.31	1	0.15	0	0.01	0	0.00
Wood	7,993	98.52	116	1.43	3	0.04	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,724 tons of debris will be generated. Of the total amount, 1,177 tons (43%) is Other Tree Debris. Of the remaining 1,547 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 19 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,080 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 6.9 million dollars, which represents 0.27 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 7 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 94% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	5,052.09	272.43	81.98	26.17	5,432.67
	Content	1,185.22	28.88	4.53	0.50	1,219.13
	Inventory	0.00	0.60	0.97	0.06	1.63
	Subtotal	6,237.32	301.91	87.48	26.74	6,653.44
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	136.32	7.76	0.53	0.23	144.85
	Rental	64.32	0.00	0.00	0.00	64.32
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	200.64	7.76	0.53	0.23	209.16
<u>Total</u>						
	Total	6,437.96	309.67	88.01	26.97	6,862.60

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	44	99.80	0	0.20	0	0.00	0	0.00	0	0.00
Commercial	625	99.74	2	0.26	0	0.00	0	0.00	0	0.00
Education	20	99.72	0	0.28	0	0.00	0	0.00	0	0.00
Government	8	99.70	0	0.30	0	0.00	0	0.00	0	0.00
Industrial	239	99.71	1	0.29	0	0.00	0	0.00	0	0.00
Religion	44	99.78	0	0.22	0	0.00	0	0.00	0	0.00
Residential	8,479	99.96	3	0.03	0	0.00	0	0.00	0	0.00
Total	9,459		6		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	116	99.66	0	0.34	0	0.00	0	0.00	0	0.00
Masonry	768	99.66	3	0.34	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	463	99.72	1	0.28	0	0.00	0	0.00	0	0.00
Wood	8,112	99.98	1	0.02	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 257 tons of debris will be generated. Of the total amount, 132 tons (51%) is Other Tree Debris. Of the remaining 125 tons, Brick/Wood comprises 7% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 116 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.4 million dollars, which represents 0.02 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	313.43	0.00	0.00	0.00	313.43
	Content	114.14	0.00	0.00	0.00	114.14
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	427.57	0.00	0.00	0.00	427.57
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.12	0.00	0.00	0.00	0.12
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.12	0.00	0.00	0.00	0.12
<u>Total</u>						
	Total	427.70	0.00	0.00	0.00	427.70

Appendix A: County Listing for the Region

Connecticut
- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

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Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	44	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	627	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	20	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	8	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	240	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	8,482	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	9,465		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	116	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	771	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	464	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	8,113	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	9

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

March 5, 2013

Study Region : North Haven 1938 Hurricane

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	21
Number of Census Tracts	4
Number of People in the Region	23,035
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	8,482	1,680,305
Commercial	627	597,865
Other	356	303,054
Total	9,465	2,581,224

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	3	0	0	0	3
50	136	6	0	0	142
100	755	71	1	1	828
200	1,766	311	18	16	2,111
500	2,950	1,015	171	135	4,272
1000	3,230	1,739	517	431	5,917

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	6	0	0	0	6
50	149	8	0	0	157
100	814	82	3	1	901
200	1,912	364	29	16	2,321
500	3,192	1,186	233	137	4,748
1000	3,480	2,006	676	438	6,599

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	6	1
200	38	8
500	233	47
1000	786	160

Economic Loss (x 1000)

ReturnPeriod	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	428	428	0
50	6,237	6,653	209
100	17,768	20,351	1,727
200	44,945	55,678	6,083
500	151,645	199,554	24,256
1000	341,653	461,329	59,053
Annualized	1,408	1,829	204

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: North Haven 1938 Hurricane

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Tuesday, March 05, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 21.07 square miles and contains 4 census tracts. There are over 8 thousand households in the region and has a total population of 23,035 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 9 thousand buildings in the region with a total building replacement value (excluding contents) of 2,581 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 9,465 buildings in the region which have an aggregate total replacement value of 2,581 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,680,305	65.1%
Commercial	597,865	23.2%
Industrial	237,098	9.2%
Agricultural	7,634	0.3%
Religious	28,938	1.1%
Government	8,929	0.3%
Education	20,455	0.8%
Total	2,581,224	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 9 schools, 4 fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	113 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,013 buildings will be at least moderately damaged. This is over 11% of the total number of buildings in the region. There are an estimated 69 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	25	57.76	11	25.47	5	10.57	2	5.33	0	0.88
Commercial	392	62.55	135	21.52	78	12.38	22	3.51	0	0.04
Education	13	64.21	4	22.25	2	11.51	0	2.03	0	0.00
Government	5	62.97	2	22.06	1	12.59	0	2.38	0	0.00
Industrial	150	62.57	50	20.79	30	12.58	9	3.77	1	0.28
Religion	28	63.10	11	25.05	4	10.22	1	1.63	0	0.00
Residential	5,050	59.54	2,576	30.37	704	8.30	85	1.00	67	0.80
Total	5,663		2,789		824		120		69	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	72	62.22	25	21.58	16	14.04	3	2.16	0	0.00
Masonry	451	58.44	173	22.49	122	15.76	22	2.91	3	0.39
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	294	63.43	86	18.64	61	13.23	21	4.63	0	0.06
Wood	4,888	60.25	2,500	30.81	588	7.25	76	0.94	61	0.75

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	4	0	0	4
Schools	9	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 38,131 tons of debris will be generated. Of the total amount, 13,396 tons (35%) is Other Tree Debris. Of the remaining 24,735 tons, Brick/Wood comprises 47% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 465 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 13,114 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 121 households to be displaced due to the hurricane. Of these, 24 people (out of a total population of 23,035) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 141.5 million dollars, which represents 5.48 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 141 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 76% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	71,650.92	11,669.14	5,482.70	1,256.87	90,059.63
	Content	26,696.30	4,805.47	3,928.31	496.94	35,927.02
	Inventory	0.00	158.71	589.82	15.93	764.47
	Subtotal	98,347.22	16,633.33	10,000.83	1,769.74	126,751.11
<u>Business Interruption Loss</u>						
	Income	0.34	581.14	63.14	63.16	707.77
	Relocation	6,373.32	2,324.88	464.82	251.92	9,414.93
	Rental	2,206.46	1,264.54	72.95	20.87	3,564.83
	Wage	0.80	561.35	97.37	378.14	1,037.66
	Subtotal	8,580.91	4,731.91	698.28	714.08	14,725.19
<u>Total</u>						
	Total	106,928.13	21,365.24	10,699.11	2,483.82	141,476.30

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	23,035	1,680,305	900,919	2,581,224
Total	23,035	1,680,305	900,919	2,581,224
Study Region Total	23,035	1,680,305	900,919	2,581,224

Hazus-MH: Earthquake Event Report

Region Name: Orange_EQ

Earthquake Scenario: Orange_Annualized

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region which has a total population of 13,233 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 (millions of dollars). Approximately 88.00 % of the buildings (and 65.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 441 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 5 thousand buildings in the region which have an aggregate total replacement value of 1,556 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 84% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 8 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 1 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 441.00 (millions of dollars). This inventory includes over 47 kilometers of highways, 12 bridges, 436 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	12	76.00
	Segments	12	337.60
	Tunnels	0	0.00
	Subtotal		413.60
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	4	28.10
	Tunnels	0	0.00
	Subtotal		28.10
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			441.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.40
Waste Water	Distribution Lines	NA	2.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.60
Natural Gas	Distribution Lines	NA	1.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.70
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			8.70

Earthquake Scenario

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

Scenario Name	Orange_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	8	0	0	0
EOCs	0	0	0	0
PoliceStations	1	0	0	0
FireStations	2	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	12	0	0	0	0
	Bridges	12	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	4	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	218	0	0
Waste Water	131	0	0
Natural Gas	87	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,739	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.01 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.01 (millions of dollars); 16 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 51 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.01

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	337.61	\$0.00	0.00
	Bridges	75.99	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	413.60	0.00	
Railways	Segments	28.11	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	28.10	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	441.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.40	\$0.00	0.00
	Subtotal	4.37	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.60	\$0.00	0.00
	Subtotal	2.62	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.70	\$0.00	0.00
	Subtotal	1.75	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	8.74	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	13,233	1,007	548	1,556
Total State		13,233	1,007	548	1,556
Total Region		13,233	1,007	548	1,556

Hazus-MH: Earthquake Event Report

Region Name: Orange_EQ

Earthquake Scenario: Orange_Probabilisti_MM_7_100yr

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region which has a total population of 13,233 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 (millions of dollars). Approximately 88.00 % of the buildings (and 65.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 441 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 5 thousand buildings in the region which have an aggregate total replacement value of 1,556 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 84% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 8 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 1 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 441.00 (millions of dollars). This inventory includes over 47 kilometers of highways, 12 bridges, 436 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	12	76.00
	Segments	12	337.60
	Tunnels	0	0.00
	Subtotal		413.60
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	4	28.10
	Tunnels	0	0.00
	Subtotal		28.10
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			441.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.40
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.40
Waste Water	Distribution Lines	NA	2.60
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.60
Natural Gas	Distribution Lines	NA	1.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.70
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
		Total	8.70

Earthquake Scenario

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

Scenario Name	Orange_Probabilisti_MM_7_100yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30	0.52	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	471	8.19	0	0.00	0	0.00	0	0.00	0	0.00
Education	10	0.17	0	0.00	0	0.00	0	0.00	0	0.00
Government	8	0.14	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	127	2.21	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	450	7.82	0	0.00	0	0.00	0	0.00	0	0.00
Religion	26	0.45	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	4,632	80.50	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,754		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,840	84.12	0	0.00	0	0.00	0	0.00	0	0.00
Steel	314	5.46	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	57	0.99	0	0.00	0	0.00	0	0.00	0	0.00
Precast	20	0.34	0	0.00	0	0.00	0	0.00	0	0.00
RM	90	1.56	0	0.00	0	0.00	0	0.00	0	0.00
URM	410	7.13	0	0.00	0	0.00	0	0.00	0	0.00
MH	23	0.40	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,754		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	8	0	0	8
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	12	0	0	12	12
	Bridges	12	0	0	12	12
	Tunnels	0	0	0	0	0
Railways	Segments	4	0	0	4	4
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	218	0	0
Waste Water	131	0	0
Natural Gas	87	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,739	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	337.61	\$0.00	0.00
	Bridges	75.99	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	413.60	0.00	
Railways	Segments	28.11	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	28.10	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	441.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.40	\$0.00	0.00
	Subtotal	4.37	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.60	\$0.00	0.00
	Subtotal	2.62	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.70	\$0.00	0.00
	Subtotal	1.75	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	8.74	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	13,233	1,007	548	1,556
Total State		13,233	1,007	548	1,556
Total Region		13,233	1,007	548	1,556

Hazus-MH: Flood Event Report

Region Name: Orange_100yr_Riverine

Flood Scenario: 100 year Riverine

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 17 square miles and contains 286 census blocks. The region contains over 5 thousand households and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,754 buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88.32% of the buildings (and 64.74% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 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	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religion	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	379,189	55.8%
Commercial	206,665	30.4%
Industrial	76,593	11.3%
Agricultural	2,189	0.3%
Religion	8,604	1.3%
Government	2,651	0.4%
Education	3,571	0.5%
Total	679,462	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police station 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:	Orange_100yr_Riverine
Scenario Name:	100 year Riverine
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 6 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	3	50.00	3	50.00	0	0.00
Total	0		0		0		3		3		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	3	50.00	3	50.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	8	0	0	0

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.

The model estimates that a total of 568 tons of debris will be generated. Of the total amount, Finishes comprises 76% of the total, Structure comprises 14% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 23 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 160 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 220 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 17.38 million dollars, which represents 2.56 % 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 17.30 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 33.41% 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	3.74	1.65	1.04	0.09	6.52
	Content	2.06	4.82	2.83	0.62	10.33
	Inventory	0.00	0.12	0.33	0.00	0.45
	Subtotal	5.81	6.60	4.19	0.71	17.30
<u>Business Interruption</u>						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.05	0.06
	Subtotal	0.00	0.03	0.00	0.05	0.08
ALL	Total	5.81	6.63	4.19	0.76	17.38

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Total Study Region	13,233	1,007,567	548,821	1,556,388

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange_100yr_Riverine
Scenario: 100 year Riverine
Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange_100yr_Riverine
 Scenario: 100 year Riverine
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	6,519	10,332	452	1.00	1	13	62	0	17,379
Total	6,519	10,332	452	1.00	1	13	62	0	17,379
Scenario Total	6,519	10,332	452	1.00	1	13	62	0	17,379

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange_100yr_Riverine
 Scenario: 100 year Riverine
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	16,096.10	21,461.47	21,461.47	21,461.47
Total	0.00	16,096.10	21,461.47	21,461.47	21,461.47
Total	0.00	16,096.10	21,461.47	21,461.47	21,461.47
Scenario Total	0.00	16,096.10	21,461.47	21,461.47	21,461.47

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange_100yr_Riverine
Scenario: 100 year Riverine
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
<div>Connecticut</div> <div>New Haven</div> <div>Total</div>		6,519	10,332	452	1.0	1	13	62	0	17,379
		6,519	10,332	452	1.0	1	13	62	0	17,379
	Scenario Total	6,519	10,332	452	1.0	1	13	62	0	17,379

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange_100yr_Riverine
 Scenario: 100 year Riverine
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Orange 500 year

Flood Scenario: 500 year

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 17 square miles and contains 286 census blocks. The region contains over 5 thousand households and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,754 buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88.32% of the buildings (and 64.74% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 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	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religion	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	443,466	66.4%
Commercial	156,436	23.4%
Industrial	48,307	7.2%
Agricultural	1,868	0.3%
Religion	9,296	1.4%
Government	2,651	0.4%
Education	5,573	0.8%
Total	667,597	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police station 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:	Orange 500 year
Scenario Name:	500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	2	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	8	0	0	0

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.

The model estimates that a total of 185 tons of debris will be generated. Of the total amount, Finishes comprises 52% of the total, Structure comprises 27% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 7 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 89 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 105 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 3.79 million dollars, which represents 0.57 % 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 3.76 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 31.80% 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	0.80	0.24	0.28	0.01	1.33
	Content	0.40	0.94	0.88	0.08	2.31
	Inventory	0.00	0.00	0.12	0.00	0.12
	Subtotal	1.20	1.19	1.28	0.10	3.76
<u>Business Interruption</u>						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.01	0.02
	Subtotal	0.00	0.02	0.00	0.01	0.03
ALL	Total	1.21	1.20	1.28	0.11	3.79

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Total Study Region	13,233	1,007,567	548,821	1,556,388

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
ALFALFA HAY	0.00	2,486.45	2,486.45	2,486.45	2,486.45
CORN SILAGE	0.00	13,652.15	18,202.86	18,202.86	18,202.86
Total	0.00	16,138.59	20,689.31	20,689.31	20,689.31
Total	0.00	16,138.59	20,689.31	20,689.31	20,689.31
Scenario Total	0.00	16,138.59	20,689.31	20,689.31	20,689.31

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange 500 year
Scenario: 500 year
Return Period: 500

Direct Economic Annualized Losses for Buildings

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,332	2,309	120	0.2	1	8	19	0	3,789
Total	1,332	2,309	120	0.2	1	8	19	0	3,789
Scenario Total	1,332	2,309	120	0.2	1	8	19	0	3,789

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Orange 500 year
 Scenario: 500 year
 Return Period: 500

Hazus-MH: Hurricane Event Report

Region Name: Orange 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	108 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 301 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 13 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	21	71.12	6	19.30	2	6.19	1	3.00	0	0.40
Commercial	355	75.34	81	17.20	30	6.39	5	1.06	0	0.01
Education	8	77.39	2	16.79	1	5.32	0	0.49	0	0.00
Government	6	76.57	1	16.89	0	5.95	0	0.59	0	0.00
Industrial	96	75.63	21	16.35	8	6.50	2	1.42	0	0.10
Religion	20	75.51	5	18.98	1	5.04	0	0.47	0	0.00
Residential	3,651	71.84	1,181	23.24	221	4.35	16	0.32	13	0.25
Total	4,157		1,297		264		24		13	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	57	74.83	13	17.33	6	7.28	0	0.56	0	0.00
Masonry	363	72.85	93	18.58	38	7.65	4	0.81	1	0.11
MH	22	95.49	1	2.69	0	1.40	0	0.06	0	0.36
Steel	241	76.39	48	15.19	22	6.85	5	1.55	0	0.02
Wood	3,501	72.34	1,127	23.29	186	3.84	15	0.31	11	0.22

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 17,371 tons of debris will be generated. Of the total amount, 7,712 tons (44%) is Other Tree Debris. Of the remaining 9,659 tons, Brick/Wood comprises 38% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 146 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 6,006 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 17 households to be displaced due to the hurricane. Of these, 3 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 40.3 million dollars, which represents 2.59 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 40 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 73% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	21,691.44	4,212.03	1,028.11	370.39	27,301.96
	Content	5,851.35	1,374.36	614.90	118.03	7,958.63
	Inventory	0.00	45.93	77.54	4.40	127.87
	Subtotal	27,542.78	5,632.31	1,720.56	492.82	35,388.46
<u>Business Interruption Loss</u>						
	Income	0.00	487.36	12.51	33.11	532.99
	Relocation	1,449.73	840.40	103.77	72.64	2,466.54
	Rental	485.75	463.09	14.38	6.28	969.50
	Wage	0.00	483.04	21.06	425.23	929.33
	Subtotal	1,935.48	2,273.90	151.72	537.26	4,898.37
<u>Total</u>						
	Total	29,478.27	7,906.21	1,872.28	1,030.08	40,286.83

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	3,643	10	6,006	7,712	17,371
Total	3,643	10	6,006	7,712	17,371
Study Region Total	3,643	10	6,006	7,712	17,371

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

1134

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	27,302	7,959	128	1.75	2,467	533	929	970	40,287
Total	27,302	7,959	128	1.75	2,467	533	929	970	40,287
Study Region Total	27,302	7,959	128	1.75	2,467	533	929	970	40,287

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

January 31, 2013

Study Region : Orange Probabilistic-Annualized

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	17
Number of Census Tracts	4
Number of People in the Region	13,233
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	5,082	1,007,567
Commercial	471	410,385
Other	201	138,436
Total	5,754	1,556,388

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	1	0	0	0	1
50	52	1	0	0	54
100	363	27	0	0	390
200	887	129	6	5	1,027
500	1,680	496	73	54	2,303
1000	1,961	897	235	184	3,276

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	3	0	0	0	3
50	60	2	0	0	62
100	398	32	1	0	431
200	976	155	11	5	1,147
500	1,845	595	101	55	2,595
1000	2,142	1,070	315	187	3,714

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	7	1
500	74	14
1000	281	54

Economic Loss (x 1000)

ReturnPeriod	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	17	17	0
50	2,035	2,202	10
100	6,488	7,678	548
200	17,015	22,149	3,031
500	65,938	88,086	12,004
1000	155,718	213,309	32,084
Annualized	624	833	113

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,572 buildings will be at least moderately damaged. This is over 27% of the total number of buildings in the region. There are an estimated 187 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	9	31.55	10	32.77	6	20.86	4	11.98	1	2.84
Commercial	165	35.00	127	27.05	123	26.05	55	11.75	1	0.15
Education	4	36.27	3	27.05	3	25.85	1	10.82	0	0.00
Government	3	34.94	2	25.59	2	26.94	1	12.53	0	0.00
Industrial	45	35.16	31	24.39	33	26.08	17	13.61	1	0.76
Religion	9	35.17	8	32.13	6	23.76	2	8.92	0	0.01
Residential	1,806	35.53	1,961	38.58	897	17.65	235	4.62	184	3.62
Total	2,040		2,142		1,070		315		187	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	26	33.83	18	23.53	23	30.58	9	12.06	0	0.00
Masonry	170	34.20	133	26.63	138	27.73	51	10.15	6	1.28
MH	18	79.29	2	6.90	2	8.10	0	1.25	1	4.46
Steel	113	35.78	70	22.13	84	26.78	47	15.07	1	0.23
Wood	1,729	35.72	1,929	39.86	814	16.82	207	4.28	161	3.33

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	8	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 59,851 tons of debris will be generated. Of the total amount, 23,888 tons (40%) is Other Tree Debris. Of the remaining 35,963 tons, Brick/Wood comprises 48% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 704 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 18,370 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 281 households to be displaced due to the hurricane. Of these, 54 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 245.4 million dollars, which represents 15.77 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 245 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 70% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	110,037.66	26,836.32	6,842.94	2,274.69	145,991.61
	Content	45,679.99	13,948.74	5,406.12	1,193.53	66,228.38
	Inventory	0.00	422.66	643.01	23.22	1,088.88
	Subtotal	155,717.65	41,207.72	12,892.07	3,491.44	213,308.87
<u>Business Interruption Loss</u>						
	Income	25.46	3,328.74	70.97	47.11	3,472.29
	Relocation	11,434.56	5,080.43	607.82	455.00	17,577.81
	Rental	3,629.76	3,071.84	93.32	43.51	6,838.43
	Wage	59.99	3,386.04	118.65	631.25	4,195.93
	Subtotal	15,149.77	14,867.06	890.76	1,176.87	32,084.45
<u>Total</u>						
	Total	170,867.41	56,074.78	13,782.83	4,668.31	245,393.32

Appendix A: County Listing for the Region

Connecticut
- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 750 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the region. There are an estimated 55 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	16	52.11	8	27.92	4	12.47	2	6.35	0	1.15
Commercial	267	56.66	116	24.55	70	14.87	18	3.87	0	0.04
Education	6	59.09	2	24.39	1	13.70	0	2.82	0	0.00
Government	5	57.99	2	23.86	1	14.82	0	3.33	0	0.00
Industrial	72	56.84	29	22.90	19	15.19	6	4.77	0	0.29
Religion	15	56.89	7	27.79	3	12.84	1	2.48	0	0.00
Residential	2,779	54.68	1,680	33.06	496	9.76	73	1.44	54	1.06
Total	3,159		1,845		595		101		55	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	42	55.64	18	23.37	13	17.70	2	3.29	0	0.00
Masonry	272	54.57	125	25.16	83	16.65	16	3.21	2	0.41
MH	21	89.18	1	5.04	1	4.02	0	0.34	0	1.42
Steel	182	57.64	67	21.26	50	15.75	17	5.27	0	0.07
Wood	2,668	55.12	1,628	33.63	432	8.94	65	1.34	47	0.98

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 36,457 tons of debris will be generated. Of the total amount, 16,056 tons (44%) is Other Tree Debris. Of the remaining 20,401 tons, Brick/Wood comprises 39% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 321 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 12,386 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 74 households to be displaced due to the hurricane. Of these, 14 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 100.1 million dollars, which represents 6.43 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 100 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 72% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	48,688.98	10,920.93	2,790.10	927.79	63,327.80
	Content	17,248.61	4,739.30	1,974.68	395.41	24,358.00
	Inventory	0.00	150.67	238.89	10.73	400.28
	Subtotal	65,937.59	15,810.89	5,003.67	1,333.92	88,086.08
<u>Business Interruption Loss</u>						
	Income	2.83	567.93	23.31	29.73	623.80
	Relocation	4,760.33	2,202.36	278.22	188.30	7,429.21
	Rental	1,528.33	1,252.32	38.60	17.09	2,836.34
	Wage	6.68	594.36	38.98	474.93	1,114.96
	Subtotal	6,298.17	4,616.97	379.11	710.05	12,004.30
<u>Total</u>						
	Total	72,235.77	20,427.86	5,382.79	2,043.97	100,090.38

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 171 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the region. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	24	78.95	4	14.80	1	4.08	1	1.95	0	0.22
Commercial	387	82.19	63	13.28	19	3.93	3	0.60	0	0.00
Education	8	84.16	1	12.70	0	2.94	0	0.21	0	0.00
Government	7	82.75	1	13.40	0	3.59	0	0.27	0	0.00
Industrial	105	82.60	16	12.66	5	3.89	1	0.80	0	0.05
Religion	21	82.65	4	14.35	1	2.80	0	0.20	0	0.00
Residential	4,055	79.79	887	17.45	129	2.54	6	0.12	5	0.10
Total	4,607		976		155		11		5	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	62	81.91	10	13.62	3	4.23	0	0.23	0	0.00
Masonry	400	80.30	72	14.46	24	4.78	2	0.41	0	0.05
MH	22	96.82	0	2.04	0	0.90	0	0.02	0	0.22
Steel	262	83.11	37	11.76	13	4.23	3	0.89	0	0.01
Wood	3,885	80.28	840	17.36	105	2.16	6	0.12	4	0.09

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 11,741 tons of debris will be generated. Of the total amount, 5,252 tons (45%) is Other Tree Debris. Of the remaining 6,489 tons, Brick/Wood comprises 38% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 98 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,031 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 7 households to be displaced due to the hurricane. Of these, 1 person (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 25.2 million dollars, which represents 1.62 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 25 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 71% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	14,150.67	2,873.95	663.83	237.81	17,926.27
	Content	2,864.51	838.82	373.60	67.11	4,144.05
	Inventory	0.00	29.16	47.16	2.63	78.95
	Subtotal	17,015.19	3,741.93	1,084.59	307.56	22,149.27
<u>Business Interruption Loss</u>						
	Income	0.00	378.07	8.80	23.62	410.48
	Relocation	665.09	556.14	63.64	44.31	1,329.19
	Rental	243.09	307.41	8.79	4.00	563.29
	Wage	0.00	373.83	14.82	339.75	728.40
	Subtotal	908.18	1,615.44	96.05	411.68	3,031.37
<u>Total</u>						
	Total	17,923.37	5,357.37	1,180.65	719.24	25,180.63

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 33 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	28	92.42	2	5.99	0	1.11	0	0.46	0	0.02
Commercial	443	94.00	24	5.13	4	0.79	0	0.09	0	0.00
Education	9	94.87	0	4.76	0	0.37	0	0.00	0	0.00
Government	8	94.53	0	5.03	0	0.43	0	0.00	0	0.00
Industrial	120	94.18	6	5.03	1	0.66	0	0.13	0	0.00
Religion	25	94.31	1	5.30	0	0.38	0	0.02	0	0.00
Residential	4,692	92.32	363	7.14	27	0.53	0	0.01	0	0.00
Total	5,323		398		32		1		0	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	71	93.90	4	5.53	0	0.57	0	0.01	0	0.00
Masonry	461	92.64	31	6.21	5	1.08	0	0.06	0	0.00
MH	23	99.49	0	0.40	0	0.09	0	0.00	0	0.01
Steel	297	94.43	14	4.60	3	0.84	0	0.13	0	0.00
Wood	4,484	92.64	336	6.94	20	0.41	1	0.01	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	8

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 6,753 tons of debris will be generated. Of the total amount, 3,324 tons (49%) is Other Tree Debris. Of the remaining 3,429 tons, Brick/Wood comprises 25% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 34 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,571 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 8.2 million dollars, which represents 0.53 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 8 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 82% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	5,953.32	786.56	155.39	65.53	6,960.81
	Content	534.96	115.92	45.51	9.49	705.88
	Inventory	0.00	4.04	6.54	0.50	11.08
	Subtotal	6,488.28	906.52	207.45	75.52	7,677.77
<u>Business Interruption Loss</u>						
	Income	0.00	59.66	1.20	9.45	70.31
	Relocation	151.30	98.01	8.91	7.83	266.06
	Rental	69.12	51.46	1.26	0.65	122.49
	Wage	0.00	64.79	1.98	22.22	88.99
	Subtotal	220.42	273.92	13.35	40.15	547.84
<u>Total</u>						
	Total	6,708.70	1,180.44	220.80	115.67	8,225.61

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 2 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30	98.79	0	1.10	0	0.09	0	0.02	0	0.00
Commercial	465	98.79	5	1.13	0	0.07	0	0.00	0	0.00
Education	10	98.88	0	1.11	0	0.01	0	0.00	0	0.00
Government	8	98.80	0	1.19	0	0.01	0	0.00	0	0.00
Industrial	125	98.79	1	1.18	0	0.03	0	0.00	0	0.00
Religion	26	98.99	0	0.99	0	0.03	0	0.00	0	0.00
Residential	5,028	98.94	52	1.03	1	0.03	0	0.00	0	0.00
Total	5,692		60		2		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	75	98.61	1	1.38	0	0.01	0	0.00	0	0.00
Masonry	490	98.43	7	1.46	0	0.10	0	0.00	0	0.00
MH	23	99.99	0	0.01	0	0.00	0	0.00	0	0.00
Steel	311	98.79	4	1.13	0	0.07	0	0.00	0	0.00
Wood	4,794	99.04	45	0.94	1	0.02	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	8

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 294 tons of debris will be generated. Of the total amount, 71 tons (24%) is Other Tree Debris. Of the remaining 223 tons, Brick/Wood comprises 80% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 7 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 44 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 2.2 million dollars, which represents 0.14 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 2 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 92% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	1,944.42	131.74	23.10	11.48	2,110.74
	Content	91.04	0.00	0.00	0.00	91.04
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	2,035.46	131.74	23.10	11.48	2,201.78
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	3.80	2.79	0.15	0.08	6.81
	Rental	3.23	0.00	0.00	0.00	3.23
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	7.03	2.79	0.15	0.08	10.04
<u>Total</u>						
	Total	2,042.49	134.53	23.25	11.55	2,211.82

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 17.40 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 13,233 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 1,556 million dollars (2006 dollars). Approximately 88% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,754 buildings in the region which have an aggregate total replacement value of 1,556 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	1,007,567	64.7%
Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30	99.81	0	0.19	0	0.00	0	0.00	0	0.00
Commercial	470	99.75	1	0.25	0	0.00	0	0.00	0	0.00
Education	10	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Government	8	99.73	0	0.28	0	0.00	0	0.00	0	0.00
Industrial	127	99.73	0	0.27	0	0.00	0	0.00	0	0.00
Religion	26	99.79	0	0.21	0	0.00	0	0.00	0	0.00
Residential	5,081	99.98	1	0.02	0	0.00	0	0.00	0	0.00
Total	5,751		3		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	76	99.68	0	0.32	0	0.00	0	0.00	0	0.00
Masonry	497	99.73	1	0.27	0	0.00	0	0.00	0	0.00
MH	23	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	314	99.73	1	0.27	0	0.00	0	0.00	0	0.00
Wood	4,840	99.99	0	0.01	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	8

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 1 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	16.53	0.00	0.00	0.00	16.53
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	16.53	0.00	0.00	0.00	16.53
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.02	0.00	0.00	0.00	0.02
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.02	0.00	0.00	0.00	0.02
<u>Total</u>						
	Total	16.55	0.00	0.00	0.00	16.55

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Hazus-MH: Hurricane Event Report

Region Name: Orange Probabilistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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Note:

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

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Building Inventory

General Building Stock

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Occupancy	Exposure (\$1000)	Percent of Tot
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Commercial	410,385	26.4%
Industrial	98,687	6.3%
Agricultural	4,250	0.3%
Religious	15,251	1.0%
Government	11,032	0.7%
Education	9,216	0.6%
Total	1,556,388	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 8 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	471	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	10	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	8	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	127	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	26	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	5,082	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	5,754		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	76	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	498	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	23	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	315	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	4,840	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	8	0	0	8

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 13,233) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

Connecticut
- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
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New Haven	13,233	1,007,567	548,821	1,556,388
Total	13,233	1,007,567	548,821	1,556,388
Study Region Total	13,233	1,007,567	548,821	1,556,388

Debris Summary Report: 10 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1	0	0	0	1
Total	1	0	0	0	1
Study Region Total	1	0	0	0	1

Debris Summary Report: 50 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	179	0	44	71	294
Total	179	0	44	71	294
Study Region Total	179	0	44	71	294

Debris Summary Report: 100 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	858	0	2,571	3,324	6,753
Total	858	0	2,571	3,324	6,753
Study Region Total	858	0	2,571	3,324	6,753

Debris Summary Report: 200 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	2,453	5	4,031	5,252	11,741
Total	2,453	5	4,031	5,252	11,741
Study Region Total	2,453	5	4,031	5,252	11,741

Debris Summary Report: 500 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	7,957	58	12,386	16,056	36,457
Total	7,957	58	12,386	16,056	36,457
Study Region Total	7,957	58	12,386	16,056	36,457

Debris Summary Report: 1000 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	17,403	190	18,370	23,888	59,851
Total	17,403	190	18,370	23,888	59,851
Study Region Total	17,403	190	18,370	23,888	59,851

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

1220

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	601	229	4	0.04	58	15	18	23	947
Total	601	229	4	0.04	58	15	18	23	947
Study Region Total	601	229	4	0.04	58	15	18	23	947

Direct Economic Losses For Buildings: 10 - year Event

1221

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

1222

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	17	0	0	0.00	0	0	0	0	17
Total	17	0	0	0.00	0	0	0	0	17
Study Region Total	17	0	0	0.00	0	0	0	0	17

Direct Economic Losses For Buildings: 50 - year Event

1223

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	2,111	91	0	0.14	7	0	0	3	2,212
Total	2,111	91	0	0.14	7	0	0	3	2,212
Study Region Total	2,111	91	0	0.14	7	0	0	3	2,212

Direct Economic Losses For Buildings: 100 - year Event

1224

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	6,961	706	11	0.45	266	70	89	122	8,226
Total	6,961	706	11	0.45	266	70	89	122	8,226
Study Region Total	6,961	706	11	0.45	266	70	89	122	8,226

Direct Economic Losses For Buildings: 200 - year Event

1225

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	17,926	4,144	79	1.15	1,329	410	728	563	25,181
Total	17,926	4,144	79	1.15	1,329	410	728	563	25,181
Study Region Total	17,926	4,144	79	1.15	1,329	410	728	563	25,181

Direct Economic Losses For Buildings: 500 - year Event

1226

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	63,328	24,358	400	4.07	7,429	624	1,115	2,836	100,090
Total	63,328	24,358	400	4.07	7,429	624	1,115	2,836	100,090
Study Region Total	63,328	24,358	400	4.07	7,429	624	1,115	2,836	100,090

Direct Economic Losses For Buildings: 1000 - year Event

1227

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	145,992	66,228	1,089	9.38	17,578	3,472	4,196	6,838	245,393
Total	145,992	66,228	1,089	9.38	17,578	3,472	4,196	6,838	245,393
Study Region Total	145,992	66,228	1,089	9.38	17,578	3,472	4,196	6,838	245,393

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : Orange Probabilistic-Annualized
Scenario : Probabilistic

Hazus-MH: Earthquake Event Report

Region Name: Wallingford_EQ

Earthquake Scenario: Wallingford_Annualized

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 46.29 square miles and contains 11 census tracts. There are over 19 thousand households in the region which has a total population of 50,712 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 19 thousand buildings in the region with a total building replacement value (excluding contents) of 5,114 (millions of dollars). Approximately 90.00 % of the buildings (and 66.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,311 and 203 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 19 thousand buildings in the region which have an aggregate total replacement value of 5,114 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 23 schools, 2 fire stations, 2 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 6 dams identified within the region. Of these, 4 of the dams are classified as 'high hazard'. The inventory also includes 60 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,514.00 (millions of dollars). This inventory includes over 77 kilometers of highways, 66 bridges, 1,014 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	66	664.30
	Segments	40	556.80
	Tunnels	0	0.00
	Subtotal		1,221.10
Railways	Bridges	1	0.00
	Facilities	1	2.70
	Segments	6	39.30
	Tunnels	0	0.00
	Subtotal		42.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	1	10.70
	Runways	1	38.00
	Subtotal		48.60
Total			1,311.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	10.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		10.10
Waste Water	Distribution Lines	NA	6.10
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		82.70
Natural Gas	Distribution Lines	NA	4.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	1	126.50
	Subtotal		126.50
Communication	Facilities	1	0.10
	Subtotal		0.10
Total			223.50

Earthquake Scenario

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

Scenario Name	Wallingford_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 591 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	0	0	0
Schools	23	0	0	0
EOCs	0	0	0	0
PoliceStations	2	0	0	0
FireStations	2	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	40	0	0	0	0
	Bridges	66	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	6	0	0	0	0
	Bridges	1	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	0	0
	Runways	1	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	0	0
Communication	1	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	507	0	0
Waste Water	304	0	0
Natural Gas	203	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	19,780	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 50,712) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.02 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.02 (millions of dollars); 17 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 52 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.01
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.01	0.00	0.00	0.00	0.00	0.01
	Total	0.01	0.00	0.01	0.00	0.00	0.02

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	556.79	\$0.00	0.00
	Bridges	664.30	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	1221.10	0.00	
Railways	Segments	39.30	\$0.00	0.00
	Bridges	0.02	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	42.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	10.65	\$0.00	0.00
	Runways	37.96	\$0.00	0.00
	Subtotal	48.60	0.00	
	Total	1311.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	10.10	\$0.00	0.00
	Subtotal	10.15	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	6.10	\$0.00	0.00
	Subtotal	82.68	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.10	\$0.00	0.00
	Subtotal	4.06	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	126.50	\$0.00	0.00
	Subtotal	126.50	\$0.00	
Communication	Facilities	0.10	\$0.00	0.00
	Subtotal	0.12	\$0.00	
	Total	223.50	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	50,712	3,381	1,733	5,114
Total State		50,712	3,381	1,733	5,114
Total Region		50,712	3,381	1,733	5,114

Hazus-MH: Earthquake Event Report

Region Name: Wallingford_EQ

Earthquake Scenario: Wallingford_Probabilistic_100yr_MM_7

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 46.29 square miles and contains 11 census tracts. There are over 19 thousand households in the region which has a total population of 50,712 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 19 thousand buildings in the region with a total building replacement value (excluding contents) of 5,114 (millions of dollars). Approximately 90.00 % of the buildings (and 66.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,311 and 203 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 19 thousand buildings in the region which have an aggregate total replacement value of 5,114 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 23 schools, 2 fire stations, 2 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 6 dams identified within the region. Of these, 4 of the dams are classified as 'high hazard'. The inventory also includes 60 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 1,514.00 (millions of dollars). This inventory includes over 77 kilometers of highways, 66 bridges, 1,014 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	66	664.30
	Segments	40	556.80
	Tunnels	0	0.00
	Subtotal		1,221.10
Railways	Bridges	1	0.00
	Facilities	1	2.70
	Segments	6	39.30
	Tunnels	0	0.00
	Subtotal		42.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	1	10.70
	Runways	1	38.00
	Subtotal		48.60
Total			1,311.70

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	10.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		10.10
Waste Water	Distribution Lines	NA	6.10
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		82.70
Natural Gas	Distribution Lines	NA	4.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		4.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	1	126.50
	Subtotal		126.50
Communication	Facilities	1	0.10
	Subtotal		0.10
Total			223.50

Earthquake Scenario

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

Scenario Name	Wallingford_Probabilistic_100yr_MM_7
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	75	0.39	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	1,159	6.10	0	0.00	0	0.00	0	0.00	0	0.00
Education	44	0.23	0	0.00	0	0.00	0	0.00	0	0.00
Government	42	0.22	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	446	2.35	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	2,588	13.62	0	0.00	0	0.00	0	0.00	0	0.00
Religion	83	0.44	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	14,563	76.65	0	0.00	0	0.00	0	0.00	0	0.00
Total	19,000		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	15,746	82.87	0	0.00	0	0.00	0	0.00	0	0.00
Steel	914	4.81	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	209	1.10	0	0.00	0	0.00	0	0.00	0	0.00
Precast	58	0.31	0	0.00	0	0.00	0	0.00	0	0.00
RM	355	1.87	0	0.00	0	0.00	0	0.00	0	0.00
URM	1,451	7.64	0	0.00	0	0.00	0	0.00	0	0.00
MH	267	1.41	0	0.00	0	0.00	0	0.00	0	0.00
Total	19,000		0		0		0		0	

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 591 hospital beds available for use. On the day of the earthquake, the model estimates that only 589 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	2	0	0	2
Schools	23	0	0	23
EOCs	0	0	0	0
PoliceStations	2	0	0	2
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	40	0	0	40	40
	Bridges	66	0	0	66	66
	Tunnels	0	0	0	0	0
Railways	Segments	6	0	0	6	6
	Bridges	1	0	0	1	1
	Tunnels	0	0	0	0	0
	Facilities	1	0	0	1	1
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	1	0	0	1	1

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	507	0	0
Waste Water	304	0	0
Natural Gas	203	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	19,780	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 50,712) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	556.79	\$0.00	0.00
	Bridges	664.30	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	1221.10	0.00	
Railways	Segments	39.30	\$0.00	0.00
	Bridges	0.02	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	2.66	\$0.00	0.00
	Subtotal	42.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	10.65	\$0.00	0.00
	Runways	37.96	\$0.00	0.00
	Subtotal	48.60	0.00	
	Total	1311.70	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	10.10	\$0.00	0.00
	Subtotal	10.15	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	6.10	\$0.00	0.00
	Subtotal	82.68	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	4.10	\$0.00	0.00
	Subtotal	4.06	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	126.50	\$0.00	0.00
	Subtotal	126.50	\$0.00	
Communication	Facilities	0.10	\$0.00	0.00
	Subtotal	0.12	\$0.00	
	Total	223.50	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	50,712	3,381	1,733	5,114
Total State		50,712	3,381	1,733	5,114
Total Region		50,712	3,381	1,733	5,114

Hazus-MH: Flood Event Report

Region Name: Wallingford 100 year Riverine

Flood Scenario: 100 year riverine

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 39 square miles and contains 569 census blocks. The region contains over 17 thousand households and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 15,792 buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90.13% of the buildings (and 64.52% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 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	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religion	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,028,443	60.1%
Commercial	327,722	19.1%
Industrial	187,155	10.9%
Agricultural	6,088	0.4%
Religion	21,301	1.2%
Government	4,120	0.2%
Education	137,729	8.0%
Total	1,712,558	100.00%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire station, 2 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:	Wallingford 100 year Riverine
Scenario Name:	100 year riverine
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 28 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the scenario. There are an estimated 6 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	2	7.14	10	35.71	10	35.71	6	21.43
Total	0		0		2		10		10		6	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	1	50.00	1	50.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	2	7.69	10	38.46	9	34.62	5	19.23

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 591 hospital beds available for use. On the day of the scenario flood event, the model estimates that 591 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	1	0	0	0
Hospitals	2	0	0	0
Police Stations	2	0	0	0
Schools	18	1	0	1

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.

The model estimates that a total of 2,023 tons of debris will be generated. Of the total amount, Finishes comprises 58% of the total, Structure comprises 24% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 81 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 505 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,057 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 106.76 million dollars, which represents 6.23 % 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 106.18 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 14.45% 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	10.16	8.66	12.10	2.20	33.11
	Content	5.26	21.02	29.30	13.31	68.89
	Inventory	0.00	0.52	3.63	0.02	4.17
	Subtotal	15.42	30.20	45.02	15.53	106.18
<u>Business Interruption</u>						
	Income	0.00	0.13	0.01	0.07	0.20
	Relocation	0.01	0.03	0.01	0.03	0.07
	Rental Income	0.00	0.02	0.00	0.00	0.02
	Wage	0.00	0.10	0.01	0.19	0.29
	Subtotal	0.01	0.27	0.02	0.28	0.58
ALL	Total	15.43	30.48	45.04	15.81	106.76

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Total Study Region	43,026	2,768,424	1,522,488	4,290,912

Direct Economic Losses for Utilities

January 31, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 100 year Riverine
Scenario: 100 year riverine
Return Period: 100

Direct Economic Loss For Transportation

January 31, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$29.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.40
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$29.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.40
Total	\$29.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.40
Scenario Total	\$29.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.40

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 100 year Riverine
 Scenario: 100 year riverine
 Return Period: 100

Direct Economic Losses for Buildings

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	33,111	68,892	4,174	1.90	71	204	289	20	106,761
Total	33,111	68,892	4,174	1.90	71	204	289	20	106,761
Scenario Total	33,111	68,892	4,174	1.90	71	204	289	20	106,761

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 100 year Riverine
 Scenario: 100 year riverine
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	201,223.68	268,298.24	268,298.24	268,298.24
Total	0.00	201,223.68	268,298.24	268,298.24	268,298.24
Total	0.00	201,223.68	268,298.24	268,298.24	268,298.24
Scenario Total	0.00	201,223.68	268,298.24	268,298.24	268,298.24

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 100 year Riverine
Scenario: 100 year riverine
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 31, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
<div>Connecticut</div> <div>New Haven</div> <div>Total</div>		33,111	68,892	4,174	1.9	71	204	289	20	106,761
		33,111	68,892	4,174	1.9	71	204	289	20	106,761
	Scenario Total	33,111	68,892	4,174	1.9	71	204	289	20	106,761

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 100 year Riverine
 Scenario: 100 year riverine
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Wallingford 500 year

Flood Scenario: 500 year riverine

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 39 square miles and contains 569 census blocks. The region contains over 17 thousand households and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 15,792 buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90.13% of the buildings (and 64.52% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 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	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religion	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	727,470	54.5%
Commercial	285,950	21.4%
Industrial	158,097	11.8%
Agricultural	3,740	0.3%
Religion	18,169	1.4%
Government	4,120	0.3%
Education	137,607	10.3%
Total	1,335,153	100.00%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire station, 2 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:	Wallingford 500 year
Scenario Name:	500 year riverine
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 591 hospital beds available for use. On the day of the scenario flood event, the model estimates that 591 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	1	0	0	0
Hospitals	2	0	0	0
Police Stations	2	0	0	0
Schools	18	0	0	0

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.

The model estimates that a total of 35 tons of debris will be generated. Of the total amount, Finishes comprises 72% of the total, Structure comprises 11% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Analysis has not been performed for this Scenario.

Economic Loss

The total economic loss estimated for the flood is 0.61 million dollars, which represents 0.05 % 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 0.59 million dollars. 3% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 34.38% 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	0.14	0.03	0.05	0.00	0.22
	Content	0.07	0.11	0.14	0.03	0.35
	Inventory	0.00	0.00	0.02	0.00	0.02
	Subtotal	0.21	0.14	0.20	0.03	0.59
<u>Business Interruption</u>						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.01	0.01
	Subtotal	0.00	0.01	0.00	0.02	0.02
ALL	Total	0.21	0.15	0.20	0.05	0.61

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Total Study Region	43,026	2,768,424	1,522,488	4,290,912

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
CORN SILAGE	0.00	15,431.63	20,575.50	20,575.50	20,575.50
Total	0.00	15,431.63	20,575.50	20,575.50	20,575.50
Total	0.00	15,431.63	20,575.50	20,575.50	20,575.50
Scenario Total	0.00	15,431.63	20,575.50	20,575.50	20,575.50

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Wallingford 500 year
 Scenario: 500 year riverine
 Return Period: 500

Hazus-MH: Hurricane Event Report

Region Name: Wallingford 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	113 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,718 buildings will be at least moderately damaged. This is over 11% of the total number of buildings in the region. There are an estimated 89 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	37	58.60	16	25.20	6	10.24	3	5.13	1	0.84
Commercial	613	62.81	217	22.21	118	12.07	28	2.89	0	0.03
Education	23	63.94	8	22.38	4	11.61	1	2.08	0	0.00
Government	28	65.58	9	21.43	5	11.11	1	1.88	0	0.00
Industrial	234	62.95	78	20.86	46	12.35	13	3.58	1	0.27
Religion	44	63.24	17	24.99	7	10.15	1	1.61	0	0.00
Residential	8,566	60.18	4,185	29.40	1,265	8.88	131	0.92	87	0.61
Total	9,544		4,530		1,451		178		89	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	143	60.84	52	22.13	35	14.91	5	2.11	0	0.00
Masonry	904	57.85	354	22.68	262	16.77	38	2.40	5	0.29
MH	246	93.18	10	3.68	6	2.34	0	0.14	2	0.67
Steel	496	63.54	153	19.59	102	13.14	29	3.69	0	0.04
Wood	7,891	60.94	3,957	30.56	910	7.03	112	0.86	80	0.62

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	2	0	0
Police Stations	2	0	0	2
Schools	18	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 69,850 tons of debris will be generated. Of the total amount, 28,283 tons (40%) is Other Tree Debris. Of the remaining 41,567 tons, Brick/Wood comprises 53% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 891 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 19,283 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 325 households to be displaced due to the hurricane. Of these, 70 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 220.7 million dollars, which represents 5.14 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 221 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 74% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	114,079.84	17,042.53	8,724.92	4,648.61	144,495.90
	Content	33,895.27	6,955.54	6,304.45	1,795.93	48,951.20
	Inventory	0.00	188.25	927.90	21.97	1,138.12
	Subtotal	147,975.11	24,186.32	15,957.27	6,466.52	194,585.22
<u>Business Interruption Loss</u>						
	Income	0.84	948.43	113.19	236.07	1,298.52
	Relocation	10,448.02	3,359.29	718.89	1,009.74	15,535.93
	Rental	5,139.86	1,845.71	119.96	99.18	7,204.71
	Wage	1.98	950.97	159.40	1,008.58	2,120.94
	Subtotal	15,590.70	7,104.39	1,111.44	2,353.57	26,160.10
<u>Total</u>						
	Total	163,565.81	31,290.71	17,068.71	8,820.09	220,745.32

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	22,160	124	19,283	28,283	69,850
Total	22,160	124	19,283	28,283	69,850
Study Region Total	22,160	124	19,283	28,283	69,850

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

1306

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	144,496	48,951	1,138	3.37	15,536	1,299	2,121	7,205	220,745
Total	144,496	48,951	1,138	3.37	15,536	1,299	2,121	7,205	220,745
Study Region Total	144,496	48,951	1,138	3.37	15,536	1,299	2,121	7,205	220,745

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

January 31, 2013

Study Region : Wallingford Probabilistic-Annualized

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	40
Number of Census Tracts	10
Number of People in the Region	43,026
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	14,234	2,768,424
Commercial	976	882,485
Other	582	640,003
Total	15,792	4,290,912

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	10	1	0	0	11
50	203	15	1	0	219
100	1,103	130	3	1	1,238
200	2,714	531	28	18	3,292
500	4,711	1,724	234	159	6,828
1000	5,365	2,943	691	491	9,490

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	15	1	0	0	15
50	224	17	1	0	241
100	1,189	144	5	1	1,340
200	2,939	604	42	19	3,604
500	5,094	1,977	314	161	7,547
1000	5,775	3,354	907	499	10,534

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	31	6
200	122	26
500	513	112
1000	1,399	305

Economic Loss (x 1000)

ReturnPeriod	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	356	356	1
50	8,031	8,639	350
100	25,314	29,065	3,073
200	65,926	82,182	10,761
500	210,580	283,016	38,522
1000	456,629	635,990	90,346
Annualized	1,955	2,593	331

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 4,759 buildings will be at least moderately damaged. This is over 30% of the total number of buildings in the region. There are an estimated 499 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	19	29.75	21	32.75	14	21.60	8	12.78	2	3.12
Commercial	322	33.02	260	26.59	260	26.65	132	13.56	2	0.18
Education	12	33.61	9	26.30	10	26.82	5	13.27	0	0.00
Government	15	34.53	11	25.29	11	27.13	5	13.05	0	0.00
Industrial	123	33.00	88	23.66	99	26.70	58	15.60	4	1.04
Religion	23	32.98	22	31.77	17	24.77	7	10.46	0	0.01
Residential	4,744	33.33	5,365	37.69	2,943	20.68	691	4.85	491	3.45
Total	5,258		5,775		3,354		907		499	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	73	30.87	53	22.75	76	32.54	33	13.84	0	0.00
Masonry	480	30.71	396	25.35	502	32.13	164	10.50	20	1.30
MH	214	81.07	18	6.79	20	7.42	3	1.02	10	3.69
Steel	262	33.55	167	21.40	217	27.87	132	16.93	2	0.25
Wood	4,354	33.62	5,215	40.27	2,343	18.09	587	4.54	450	3.48

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 15.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	2	1	0
Police Stations	2	0	0	2
Schools	18	18	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 151,337 tons of debris will be generated. Of the total amount, 54,165 tons (36%) is Other Tree Debris. Of the remaining 97,172 tons, Brick/Wood comprises 62% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2424 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 36,581 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,399 households to be displaced due to the hurricane. Of these, 305 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 726.3 million dollars, which represents 16.93 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 726 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 70% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	328,718.79	60,537.17	30,623.93	17,343.84	437,223.72
	Content	127,910.30	32,368.93	25,383.25	8,774.47	194,436.95
	Inventory	0.00	807.64	3,454.74	66.59	4,328.97
	Subtotal	456,629.09	93,713.74	59,461.91	26,184.91	635,989.64
<u>Business Interruption Loss</u>						
	Income	41.22	6,421.19	505.12	341.74	7,309.28
	Relocation	34,760.20	11,150.85	2,278.98	3,704.39	51,894.43
	Rental	14,685.45	6,657.04	419.47	412.06	22,174.02
	Wage	97.11	6,788.64	746.16	1,336.35	8,968.25
	Subtotal	49,583.98	31,017.73	3,949.74	5,794.54	90,345.98
<u>Total</u>						
	Total	506,213.07	124,731.46	63,411.65	31,979.44	726,335.63

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 2,453 buildings will be at least moderately damaged. This is over 16% of the total number of buildings in the region. There are an estimated 161 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	32	51.27	18	27.98	8	12.87	4	6.66	1	1.23
Commercial	525	53.77	242	24.78	161	16.45	48	4.94	0	0.05
Education	20	55.13	9	24.88	6	16.02	1	3.97	0	0.00
Government	25	60.51	10	22.74	6	13.70	1	3.05	0	0.00
Industrial	200	53.83	85	22.95	63	16.80	22	5.99	2	0.43
Religion	36	52.60	20	28.85	10	15.08	2	3.47	0	0.00
Residential	7,406	52.03	4,711	33.10	1,724	12.11	234	1.65	159	1.11
Total	8,245		5,094		1,977		314		161	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	121	51.43	56	23.66	49	20.75	10	4.16	0	0.00
Masonry	772	49.40	384	24.55	338	21.63	61	3.93	8	0.48
MH	233	88.33	14	5.29	12	4.38	1	0.41	4	1.58
Steel	425	54.52	167	21.36	139	17.77	49	6.27	1	0.08
Wood	6,836	52.79	4,494	34.70	1,273	9.83	200	1.55	145	1.12

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 15.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	2	1	0
Police Stations	2	0	0	2
Schools	18	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 89,085 tons of debris will be generated. Of the total amount, 33,523 tons (38%) is Other Tree Debris. Of the remaining 55,562 tons, Brick/Wood comprises 54% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1217 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 25,127 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 513 households to be displaced due to the hurricane. Of these, 112 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 321.5 million dollars, which represents 7.49 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 322 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 73% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	158,529.32	26,048.09	13,575.71	6,267.41	204,420.53
	Content	52,050.33	11,780.61	10,354.68	2,608.43	76,794.06
	Inventory	0.00	310.48	1,459.84	30.63	1,800.95
	Subtotal	210,579.65	38,139.18	25,390.23	8,906.47	283,015.54
<u>Business Interruption Loss</u>						
	Income	3.50	1,402.66	179.31	218.04	1,803.52
	Relocation	16,004.09	5,075.13	1,110.16	1,372.92	23,562.30
	Rental	7,332.56	2,845.54	188.49	137.25	10,503.84
	Wage	8.26	1,412.73	258.59	972.42	2,652.01
	Subtotal	23,348.42	10,736.06	1,736.56	2,700.64	38,521.68
<u>Total</u>						
	Total	233,928.07	48,875.24	27,126.79	11,607.12	321,537.22

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
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New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
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Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 665 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 19 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	48	75.85	10	16.66	3	4.88	1	2.33	0	0.27
Commercial	781	80.01	141	14.43	47	4.78	8	0.78	0	0.00
Education	29	81.20	5	14.47	1	4.02	0	0.30	0	0.00
Government	34	80.91	6	14.52	2	4.25	0	0.33	0	0.00
Industrial	298	80.19	52	13.92	18	4.77	4	1.04	0	0.08
Religion	56	80.85	11	15.51	2	3.40	0	0.24	0	0.00
Residential	10,942	76.87	2,714	19.07	531	3.73	28	0.20	18	0.13
Total	12,188		2,939		604		42		19	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	186	79.14	36	15.29	12	5.28	1	0.29	0	0.00
Masonry	1,173	75.08	250	16.00	127	8.10	12	0.75	1	0.08
MH	258	97.78	4	1.50	2	0.58	0	0.01	0	0.13
Steel	630	80.78	102	13.09	40	5.13	8	0.99	0	0.01
Wood	10,053	77.64	2,510	19.38	346	2.67	24	0.18	16	0.13

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	1	0	0
Police Stations	2	0	0	2
Schools	18	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 36,751 tons of debris will be generated. Of the total amount, 15,465 tons (42%) is Other Tree Debris. Of the remaining 21,286 tons, Brick/Wood comprises 51% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 437 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 10,354 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 122 households to be displaced due to the hurricane. Of these, 26 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 92.9 million dollars, which represents 2.17 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 93 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 77% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	54,152.81	6,558.16	3,180.28	1,714.88	65,606.12
	Content	11,773.52	1,972.25	1,981.73	473.17	16,200.68
	Inventory	0.00	56.16	310.82	8.57	375.55
	Subtotal	65,926.33	8,586.57	5,472.83	2,196.63	82,182.36
<u>Business Interruption Loss</u>						
	Income	0.00	925.86	51.71	192.84	1,170.41
	Relocation	3,185.16	1,282.98	249.18	342.65	5,059.96
	Rental	2,114.78	707.04	43.22	32.77	2,897.81
	Wage	0.00	830.74	71.22	731.36	1,633.32
	Subtotal	5,299.94	3,746.62	415.33	1,299.61	10,761.50
<u>Total</u>						
	Total	71,226.27	12,333.19	5,888.16	3,496.24	92,943.86

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 151 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	58	91.86	4	6.40	1	1.20	0	0.51	0	0.03
Commercial	912	93.41	54	5.52	9	0.96	1	0.11	0	0.00
Education	34	94.04	2	5.46	0	0.50	0	0.01	0	0.00
Government	40	94.44	2	5.11	0	0.45	0	0.01	0	0.00
Industrial	348	93.51	20	5.50	3	0.81	1	0.18	0	0.01
Religion	65	93.67	4	5.85	0	0.47	0	0.02	0	0.00
Residential	12,996	91.30	1,103	7.75	130	0.92	3	0.02	1	0.01
Total	14,452		1,189		144		5		1	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	219	92.98	15	6.28	2	0.73	0	0.01	0	0.00
Masonry	1,404	89.82	117	7.48	40	2.53	2	0.15	0	0.01
MH	263	99.61	1	0.31	0	0.07	0	0.00	0	0.01
Steel	732	93.81	40	5.10	7	0.95	1	0.14	0	0.00
Wood	11,905	91.93	977	7.55	63	0.49	3	0.02	1	0.01

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 591 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	1	0	2
Police Stations	2	0	0	2
Schools	18	0	0	18

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 17,976 tons of debris will be generated. Of the total amount, 8,067 tons (45%) is Other Tree Debris. Of the remaining 9,909 tons, Brick/Wood comprises 42% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 168 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 5,717 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 31 households to be displaced due to the hurricane. Of these, 6 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 32.1 million dollars, which represents 0.75 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 32 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	22,220.35	1,819.29	742.28	427.52	25,209.44
	Content	3,093.55	315.44	318.11	63.17	3,790.27
	Inventory	0.00	8.61	55.22	1.55	65.39
	Subtotal	25,313.91	2,143.33	1,115.62	492.24	29,065.09
<u>Business Interruption Loss</u>						
	Income	0.00	307.14	10.43	37.86	355.44
	Relocation	865.40	332.87	39.31	41.24	1,278.82
	Rental	795.73	200.05	7.80	4.04	1,007.63
	Wage	0.00	300.17	14.11	117.01	431.29
	Subtotal	1,661.13	1,140.24	71.65	200.16	3,073.18
<u>Total</u>						
	Total	26,975.04	3,283.57	1,187.27	692.40	32,138.27

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 17 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	62	98.57	1	1.29	0	0.11	0	0.03	0	0.00
Commercial	962	98.61	12	1.28	1	0.11	0	0.00	0	0.00
Education	36	98.70	0	1.29	0	0.02	0	0.00	0	0.00
Government	41	98.73	1	1.26	0	0.01	0	0.00	0	0.00
Industrial	367	98.57	5	1.37	0	0.05	0	0.01	0	0.00
Religion	68	98.80	1	1.17	0	0.03	0	0.00	0	0.00
Residential	14,015	98.46	203	1.43	15	0.11	1	0.00	0	0.00
Total	15,551		224		17		1		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	231	98.35	4	1.64	0	0.02	0	0.00	0	0.00
Masonry	1,522	97.36	35	2.24	6	0.39	0	0.01	0	0.00
MH	264	99.99	0	0.01	0	0.00	0	0.00	0	0.00
Steel	769	98.61	10	1.31	1	0.09	0	0.00	0	0.00
Wood	12,789	98.77	155	1.20	5	0.04	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 591 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	1	0	2
Police Stations	2	0	0	2
Schools	18	0	0	18

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2,806 tons of debris will be generated. Of the total amount, 811 tons (29%) is Other Tree Debris. Of the remaining 1,995 tons, Brick/Wood comprises 53% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 42 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 946 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 9.0 million dollars, which represents 0.21 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 9 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 93% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	7,160.26	363.14	121.05	80.84	7,725.29
	Content	871.17	27.24	11.44	0.37	910.23
	Inventory	0.00	0.60	2.45	0.05	3.10
	Subtotal	8,031.43	390.98	134.94	81.26	8,638.62
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	166.51	8.25	0.62	0.50	175.90
	Rental	174.11	0.00	0.00	0.00	174.11
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	340.63	8.25	0.62	0.50	350.01
<u>Total</u>						
	Total	8,372.06	399.24	135.57	81.76	8,988.62

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	63	99.81	0	0.19	0	0.00	0	0.00	0	0.00
Commercial	973	99.74	3	0.26	0	0.00	0	0.00	0	0.00
Education	36	99.73	0	0.27	0	0.00	0	0.00	0	0.00
Government	42	99.71	0	0.29	0	0.00	0	0.00	0	0.00
Industrial	371	99.71	1	0.29	0	0.00	0	0.00	0	0.00
Religion	69	99.78	0	0.22	0	0.00	0	0.00	0	0.00
Residential	14,223	99.92	10	0.07	1	0.00	0	0.00	0	0.00
Total	15,777		15		1		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	234	99.65	1	0.35	0	0.00	0	0.00	0	0.00
Masonry	1,557	99.61	6	0.38	0	0.01	0	0.00	0	0.00
MH	264	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	778	99.71	2	0.29	0	0.00	0	0.00	0	0.00
Wood	12,946	99.97	3	0.02	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 591 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	0	0	2
Police Stations	2	0	0	2
Schools	18	0	0	18

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 209 tons of debris will be generated. Of the total amount, 84 tons (40%) is Other Tree Debris. Of the remaining 125 tons, Brick/Wood comprises 29% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 89 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.4 million dollars, which represents 0.01 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	292.85	0.00	0.00	0.00	292.85
	Content	63.54	0.00	0.00	0.00	63.54
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	356.38	0.00	0.00	0.00	356.38
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.77	0.00	0.00	0.00	0.77
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.77	0.00	0.00	0.00	0.77
<u>Total</u>						
	Total	357.16	0.00	0.00	0.00	357.16

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Hazus-MH: Hurricane Event Report

Region Name: Wallingford Probabilistic-Annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 39.82 square miles and contains 10 census tracts. There are over 16 thousand households in the region and has a total population of 43,026 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 15 thousand buildings in the region with a total building replacement value (excluding contents) of 4,291 million dollars (2006 dollars). Approximately 90% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 15,792 buildings in the region which have an aggregate total replacement value of 4,291 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	2,768,424	64.5%
Commercial	882,485	20.6%
Industrial	374,863	8.7%
Agricultural	11,171	0.3%
Religious	49,707	1.2%
Government	47,007	1.1%
Education	157,255	3.7%
Total	4,290,912	100.0%

Essential Facility Inventory

For essential facilities, there are 2 hospitals in the region with a total bed capacity of 591 beds. There are 18 schools, 1 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	63	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	976	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	36	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	42	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	372	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	69	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	14,234	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	15,792		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	235	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,563	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	264	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	780	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	12,949	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 591 hospital beds available for use. On the day of the hurricane, the model estimates that 591 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Hospitals	2	0	0	2
Police Stations	2	0	0	2
Schools	18	0	0	18

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 43,026) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	43,026	2,768,424	1,522,488	4,290,912
Total	43,026	2,768,424	1,522,488	4,290,912
Study Region Total	43,026	2,768,424	1,522,488	4,290,912

Debris Summary Report: 10 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	36	0	89	84	209
Total	36	0	89	84	209
Study Region Total	36	0	89	84	209

Debris Summary Report: 50 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1,049	0	946	811	2,806
Total	1,049	0	946	811	2,806
Study Region Total	1,049	0	946	811	2,806

Debris Summary Report: 100 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	4,190	2	5,717	8,067	17,976
Total	4,190	2	5,717	8,067	17,976
Study Region Total	4,190	2	5,717	8,067	17,976

Debris Summary Report: 200 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	10,904	28	10,354	15,465	36,751
Total	10,904	28	10,354	15,465	36,751
Study Region Total	10,904	28	10,354	15,465	36,751

Debris Summary Report: 500 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	30,211	224	25,127	33,523	89,085
Total	30,211	224	25,127	33,523	89,085
Study Region Total	30,211	224	25,127	33,523	89,085

Debris Summary Report: 1000 - year Event

January 31, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	59,974	617	36,581	54,165	151,337
Total	59,974	617	36,581	54,165	151,337
Study Region Total	59,974	617	36,581	54,165	151,337

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

1392

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,880	699	15	0.04	178	31	38	85	2,925
Total	1,880	699	15	0.04	178	31	38	85	2,925
Study Region Total	1,880	699	15	0.04	178	31	38	85	2,925

Direct Economic Losses For Buildings: 10 - year Event

1393

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

1394

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	293	64	0	0.01	1	0	0	0	357
Total	293	64	0	0.01	1	0	0	0	357
Study Region Total	293	64	0	0.01	1	0	0	0	357

Direct Economic Losses For Buildings: 50 - year Event

1395

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	7,725	910	3	0.18	176	0	0	174	8,989
Total	7,725	910	3	0.18	176	0	0	174	8,989
Study Region Total	7,725	910	3	0.18	176	0	0	174	8,989

Direct Economic Losses For Buildings: 100 - year Event

1396

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	25,209	3,790	65	0.59	1,279	355	431	1,008	32,138
Total	25,209	3,790	65	0.59	1,279	355	431	1,008	32,138
Study Region Total	25,209	3,790	65	0.59	1,279	355	431	1,008	32,138

Direct Economic Losses For Buildings: 200 - year Event

1397

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	65,606	16,201	376	1.53	5,060	1,170	1,633	2,898	92,944
Total	65,606	16,201	376	1.53	5,060	1,170	1,633	2,898	92,944
Study Region Total	65,606	16,201	376	1.53	5,060	1,170	1,633	2,898	92,944

Direct Economic Losses For Buildings: 500 - year Event

1398

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	204,421	76,794	1,801	4.76	23,562	1,804	2,652	10,504	321,537
Total	204,421	76,794	1,801	4.76	23,562	1,804	2,652	10,504	321,537
Study Region Total	204,421	76,794	1,801	4.76	23,562	1,804	2,652	10,504	321,537

Direct Economic Losses For Buildings: 1000 - year Event

1399

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	437,224	194,437	4,329	10.19	51,894	7,309	8,968	22,174	726,336
Total	437,224	194,437	4,329	10.19	51,894	7,309	8,968	22,174	726,336
Study Region Total	437,224	194,437	4,329	10.19	51,894	7,309	8,968	22,174	726,336

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Hazus-MH: Earthquake Event Report

Region Name: West Haven EQ

Earthquake Scenario: West_Haven_Annualized

Print Date: March 07, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region which has a total population of 52,360 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,952 (millions of dollars). Approximately 91.00 % of the buildings (and 77.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 435 and 77 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 16 thousand buildings in the region which have an aggregate total replacement value of 3,952 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 82% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 5 dams identified within the region. Of these, 3 of the dams are classified as 'high hazard'. The inventory also includes 6 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 512.00 (millions of dollars). This inventory includes over 22 kilometers of highways, 13 bridges, 507 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	13	241.40
	Segments	4	175.50
	Tunnels	0	0.00
	Subtotal		417.00
Railways	Bridges	1	0.10
	Facilities	0	0.00
	Segments	1	15.20
	Tunnels	0	0.00
	Subtotal		15.20
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	1	2.00
	Subtotal		2.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			435.50

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.10
Waste Water	Distribution Lines	NA	3.00
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.60
Natural Gas	Distribution Lines	NA	2.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.00
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	4	0.50
	Subtotal		0.50
		Total	87.20

Earthquake Scenario

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

Scenario Name	West_Haven_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:

RM Reinforced Masonry
 URM Unreinforced Masonry
 MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 200 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	0
Schools	17	0	0	0
EOCs	0	0	0	0
PoliceStations	1	0	0	0
FireStations	3	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	4	0	0	0	0
	Bridges	13	0	0	0	0
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	0	0
	Bridges	1	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	1	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	4	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	254	0	0
Waste Water	152	0	0
Natural Gas	101	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	21,090	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.01 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.01 (millions of dollars); 16 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 68 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.01
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.01
	Total	0.00	0.00	0.00	0.00	0.00	0.01

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	175.54	\$0.00	0.00
	Bridges	241.43	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	417.00	0.00	
Railways	Segments	15.18	\$0.00	0.00
	Bridges	0.07	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	15.20	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.00
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	2.00	\$0.00	0.00
	Subtotal	2.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	435.50	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.10	\$0.00	0.00
	Subtotal	5.07	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.00	\$0.00	0.00
	Subtotal	79.63	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.00	\$0.00	0.00
	Subtotal	2.03	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.50	\$0.00	0.00
	Subtotal	0.46	\$0.00	
	Total	87.20	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	52,360	3,035	917	3,952
Total State		52,360	3,035	917	3,952
Total Region		52,360	3,035	917	3,952

Hazus-MH: Earthquake Event Report

Region Name: West Haven EQ

Earthquake Scenario: West Haven Probabilistic MM7

Print Date: March 07, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region which has a total population of 52,360 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,952 (millions of dollars). Approximately 91.00 % of the buildings (and 77.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 435 and 77 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 16 thousand buildings in the region which have an aggregate total replacement value of 3,952 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 82% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 5 dams identified within the region. Of these, 3 of the dams are classified as 'high hazard'. The inventory also includes 6 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 512.00 (millions of dollars). This inventory includes over 22 kilometers of highways, 13 bridges, 507 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	13	241.40
	Segments	4	175.50
	Tunnels	0	0.00
	Subtotal		417.00
Railways	Bridges	1	0.10
	Facilities	0	0.00
	Segments	1	15.20
	Tunnels	0	0.00
	Subtotal		15.20
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	1	1.30
	Subtotal		1.30
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	1	2.00
	Subtotal		2.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			435.50

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	5.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		5.10
Waste Water	Distribution Lines	NA	3.00
	Facilities	1	76.60
	Pipelines	0	0.00
	Subtotal		79.60
Natural Gas	Distribution Lines	NA	2.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.00
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	4	0.50
	Subtotal		0.50
Total			87.20

Earthquake Scenario

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

Scenario Name	West Haven Probabilistic MM7
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	39	0.24	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	946	5.83	0	0.00	0	0.00	0	0.00	0	0.00
Education	23	0.14	0	0.00	0	0.00	0	0.00	0	0.00
Government	28	0.17	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	299	1.84	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	3,307	20.37	0	0.00	0	0.00	0	0.00	0	0.00
Religion	64	0.39	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	11,529	71.01	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,235		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	13,335	82.13	0	0.00	0	0.00	0	0.00	0	0.00
Steel	732	4.51	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	219	1.35	0	0.00	0	0.00	0	0.00	0	0.00
Precast	44	0.27	0	0.00	0	0.00	0	0.00	0	0.00
RM	409	2.52	0	0.00	0	0.00	0	0.00	0	0.00
URM	1,450	8.93	0	0.00	0	0.00	0	0.00	0	0.00
MH	46	0.28	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,235		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 200 hospital beds available for use. On the day of the earthquake, the model estimates that only 199 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	17	0	0	17
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	3	0	0	3

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	4	0	0	4	4
	Bridges	13	0	0	13	13
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	1	0	0	1	1
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	1	0	0	1	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	4	0	0	4	4

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	254	0	0
Waste Water	152	0	0
Natural Gas	101	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	21,090	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	175.54	\$0.00	0.00
	Bridges	241.43	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Subtotal	417.00	0.00	
Railways	Segments	15.18	\$0.00	0.00
	Bridges	0.07	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	15.20	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	1.25	\$0.00	0.00
	Subtotal	1.30	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	2.00	\$0.00	0.00
	Subtotal	2.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	435.50	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	5.10	\$0.00	0.00
	Subtotal	5.07	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	76.60	\$0.00	0.00
	Distribution Lines	3.00	\$0.00	0.00
	Subtotal	79.63	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.00	\$0.00	0.00
	Subtotal	2.03	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.50	\$0.00	0.00
	Subtotal	0.46	\$0.00	
	Total	87.20	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	52,360	3,035	917	3,952
Total State		52,360	3,035	917	3,952
Total Region		52,360	3,035	917	3,952

Hazus-MH: Flood Event Report

Region Name: west haven 500 year

Flood Scenario: 500 year

Print Date: Monday, March 11, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 11 square miles and contains 593 census blocks. The region contains over 21 thousand households and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 16,235 buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91.38% of the buildings (and 76.79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 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	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religion	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	360,358	70.1%
Commercial	77,341	15.1%
Industrial	59,105	11.5%
Agricultural	329	0.1%
Religion	12,849	2.5%
Government	3,834	0.7%
Education	0	0.0%
Total	513,816	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police station 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:	west haven 500 year
Scenario Name:	500 year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 11 buildings will be at least moderately damaged. This is over 22% of the total number of buildings in the scenario. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	3	27.27	3	27.27	5	45.45
Total	0		0		0		3		3		5	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	3	27.27	3	27.27	5	45.45

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 200 hospital beds available for use. On the day of the scenario flood event, the model estimates that 200 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	3	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	17	0	0	0

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.

The model estimates that a total of 853 tons of debris will be generated. Of the total amount, Finishes comprises 37% of the total, Structure comprises 37% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 34 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 318 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 806 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 11.21 million dollars, which represents 2.18 % 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 11.17 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.03% 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	3.09	0.51	0.86	0.11	4.58
	Content	1.62	1.14	2.67	0.67	6.10
	Inventory	0.00	0.03	0.46	0.00	0.49
	Subtotal	4.71	1.68	4.00	0.78	11.17
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.04	0.04
	Subtotal	0.00	0.00	0.00	0.04	0.04
ALL	Total	4.71	1.69	4.00	0.82	11.21

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Total Study Region	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Flood Event Report

Region Name: west haven depth grid flood

Flood Scenario: Depth Grids 100 year

Print Date: Thursday, March 07, 2013

Disclaimer:

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

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

- Connecticut

Note:

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

The geographical size of the region is 11 square miles and contains 593 census blocks. The region contains over 21 thousand households and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 16,235 buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91.38% of the buildings (and 76.79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 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	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religion	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,194,775	73.3%
Commercial	260,092	16.0%
Industrial	133,360	8.2%
Agricultural	2,100	0.1%
Religion	22,675	1.4%
Government	9,443	0.6%
Education	7,667	0.5%
Total	1,630,112	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police station 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:	west haven depth grid flood
Scenario Name:	Depth Grids 100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 97 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the scenario. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	16	16.49	22	22.68	36	37.11	16	16.49	7	7.22
Total	0		16		22		36		16		7	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	16	16.49	22	22.68	36	37.11	16	16.49	7	7.22

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 200 hospital beds available for use. On the day of the scenario flood event, the model estimates that 200 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	3	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	17	0	0	0

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.

The model estimates that a total of 3,893 tons of debris will be generated. Of the total amount, Finishes comprises 62% of the total, Structure comprises 23% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 156 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 1,840 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 4,852 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 50.03 million dollars, which represents 3.07 % 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 49.71 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 59.69% 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	18.02	2.69	1.53	0.63	22.87
	Content	11.79	6.79	3.73	3.67	25.98
	Inventory	0.00	0.20	0.67	0.00	0.87
	Subtotal	29.81	9.68	5.92	4.30	49.71
<u>Business Interruption</u>						
	Income	0.00	0.06	0.00	0.01	0.07
	Relocation	0.03	0.01	0.00	0.00	0.04
	Rental Income	0.01	0.01	0.00	0.00	0.02
	Wage	0.00	0.06	0.00	0.13	0.19
	Subtotal	0.05	0.14	0.00	0.13	0.32
ALL	Total	29.86	9.82	5.92	4.43	50.03

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Total Study Region	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Flood Event Report

Region Name: West Haven DG Coastal

Flood Scenario: 100 Coastal

Print Date: Thursday, March 07, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 11 square miles and contains 593 census blocks. The region contains over 21 thousand households and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 16,235 buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91.38% of the buildings (and 76.79% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 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	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religion	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	262,670	82.2%
Commercial	38,633	12.1%
Industrial	13,839	4.3%
Agricultural	304	0.1%
Religion	3,171	1.0%
Government	1,046	0.3%
Education	0	0.0%
Total	319,663	100.00%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police station 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:	West Haven DG Coastal
Scenario Name:	100 Coastal
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 50 buildings will be at least moderately damaged. This is over 50% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	6	12.00	18	36.00	13	26.00	13	26.00	0	0.00
Total	0		6		18		13		13		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	6	12.00	18	36.00	13	26.00	13	26.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 200 hospital beds available for use. On the day of the scenario flood event, the model estimates that 200 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	3	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	17	0	0	0

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.

The model estimates that a total of 2,975 tons of debris will be generated. Of the total amount, Finishes comprises 31% of the total, Structure comprises 43% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 119 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 201 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 445 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 11.93 million dollars, which represents 3.73 % 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 11.81 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 75.25% 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	5.35	0.75	0.13	0.01	6.24
	Content	3.61	1.66	0.19	0.05	5.52
	Inventory	0.00	0.03	0.03	0.00	0.05
	Subtotal	8.97	2.44	0.35	0.06	11.81
<u>Business Interruption</u>						
	Income	0.00	0.02	0.00	0.00	0.02
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.08	0.09
	Subtotal	0.01	0.03	0.00	0.08	0.13
ALL	Total	8.98	2.47	0.35	0.14	11.93

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Total Study Region	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	111 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,648 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 60 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	24	62.26	9	23.58	4	9.06	2	4.43	0	0.67
Commercial	623	65.84	194	20.46	103	10.91	26	2.76	0	0.03
Education	16	67.94	5	20.89	2	9.88	0	1.29	0	0.00
Government	19	67.01	6	20.89	3	10.66	0	1.44	0	0.00
Industrial	197	65.72	60	20.13	33	11.12	8	2.81	1	0.22
Religion	43	67.27	15	23.24	5	8.46	1	1.02	0	0.00
Residential	9,285	62.58	4,093	27.59	1,302	8.78	98	0.66	59	0.40
Total	10,206		4,381		1,453		135		60	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	162	61.72	59	22.32	39	14.71	3	1.24	0	0.00
Masonry	1,072	57.76	405	21.83	348	18.74	28	1.50	3	0.17
MH	42	93.95	2	3.39	1	1.97	0	0.10	0	0.59
Steel	478	65.40	136	18.66	92	12.57	24	3.33	0	0.04
Wood	8,592	64.45	3,819	28.65	781	5.86	82	0.61	58	0.44

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	0	0
Police Stations	1	0	0	1
Schools	17	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 35,431 tons of debris will be generated. Of the total amount, 2,409 tons (7%) is Other Tree Debris. Of the remaining 33,022 tons, Brick/Wood comprises 69% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 915 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 10,144 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 463 households to be displaced due to the hurricane. Of these, 120 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 188.1 million dollars, which represents 4.76 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 188 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	114,784.49	9,271.62	3,835.39	1,751.40	129,642.89
	Content	28,498.72	3,784.81	2,727.17	655.50	35,666.20
	Inventory	0.00	142.77	466.53	8.53	617.83
	Subtotal	143,283.21	13,199.20	7,029.09	2,415.42	165,926.92
<u>Business Interruption Loss</u>						
	Income	0.19	663.74	48.32	147.29	859.53
	Relocation	9,689.85	1,825.13	297.16	369.61	12,181.75
	Rental	6,384.67	920.52	49.18	43.37	7,397.75
	Wage	0.44	755.56	79.50	882.09	1,717.59
	Subtotal	16,075.15	4,164.94	474.16	1,442.36	22,156.62
<u>Total</u>						
	Total	159,358.36	17,364.14	7,503.25	3,857.79	188,083.54

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Direct Economic Losses For Buildings: Annualized Losses

1482

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	2,391	834	13	0.06	216	28	37	124	3,643
Total	2,391	834	13	0.06	216	28	37	124	3,643
Study Region Total	2,391	834	13	0.06	216	28	37	124	3,643

Direct Economic Losses For Buildings: 10 - year Event

1483

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

1484

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	719	162	0	0.02	2	0	0	0	882
Total	719	162	0	0.02	2	0	0	0	882
Study Region Total	719	162	0	0.02	2	0	0	0	882

Direct Economic Losses For Buildings: 50 - year Event

1485

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	10,589	1,550	2	0.27	454	0	0	409	13,003
Total	10,589	1,550	2	0.27	454	0	0	409	13,003
Study Region Total	10,589	1,550	2	0.27	454	0	0	409	13,003

Direct Economic Losses For Buildings: 100 - year Event

1486

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	36,542	5,944	63	0.92	2,014	257	457	1,872	47,149
Total	36,542	5,944	63	0.92	2,014	257	457	1,872	47,149
Study Region Total	36,542	5,944	63	0.92	2,014	257	457	1,872	47,149

Direct Economic Losses For Buildings: 200 - year Event

1487

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	90,060	21,368	364	2.28	7,151	790	1,480	4,867	126,080
Total	90,060	21,368	364	2.28	7,151	790	1,480	4,867	126,080
Study Region Total	90,060	21,368	364	2.28	7,151	790	1,480	4,867	126,080

Direct Economic Losses For Buildings: 500 - year Event

1488

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	270,989	96,092	1,692	6.86	30,480	1,802	2,854	15,634	419,542
Total	270,989	96,092	1,692	6.86	30,480	1,802	2,854	15,634	419,542
Study Region Total	270,989	96,092	1,692	6.86	30,480	1,802	2,854	15,634	419,542

Direct Economic Losses For Buildings: 1000 - year Event

1489

May 6, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	545,365	229,542	3,813	13.80	60,244	8,559	10,416	29,765	887,704
Total	545,365	229,542	3,813	13.80	60,244	8,559	10,416	29,765	887,704
Study Region Total	545,365	229,542	3,813	13.80	60,244	8,559	10,416	29,765	887,704

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : West Haven CT Annualized Hurricane
 Scenario : Probabilistic

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 6,210 buildings will be at least moderately damaged. This is over 38% of the total number of buildings in the region. There are an estimated 690 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	9	23.47	13	32.14	10	24.36	6	15.67	2	4.36
Commercial	259	27.36	231	24.42	268	28.38	184	19.47	3	0.37
Education	7	28.75	6	24.89	7	28.79	4	17.55	0	0.01
Government	8	28.56	7	23.63	8	29.21	5	18.60	0	0.00
Industrial	80	26.81	66	22.24	86	28.64	62	20.88	4	1.43
Religion	18	27.79	20	31.09	17	27.29	9	13.80	0	0.03
Residential	3,838	25.87	5,464	36.83	3,855	25.98	999	6.73	680	4.58
Total	4,219		5,806		4,251		1,270		690	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	63	23.99	53	20.22	100	38.17	46	17.62	0	0.00
Masonry	451	24.30	445	23.97	723	38.97	209	11.26	28	1.50
MH	34	74.69	3	6.98	4	9.62	1	1.87	3	6.83
Steel	198	27.15	139	19.01	222	30.36	168	23.04	3	0.44
Wood	3,550	26.63	5,349	40.12	2,926	21.94	839	6.30	668	5.01

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	1	0
Police Stations	1	1	0	1
Schools	17	17	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 112,895 tons of debris will be generated. Of the total amount, 5,747 tons (5%) is Other Tree Debris. Of the remaining 107,148 tons, Brick/Wood comprises 77% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3350 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 23,407 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2,846 households to be displaced due to the hurricane. Of these, 723 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 887.7 million dollars, which represents 22.46 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 888 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 80% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	462,013.09	52,574.00	20,756.51	10,021.76	545,365.35
	Content	175,865.47	30,344.49	17,570.03	5,761.84	229,541.83
	Inventory	0.00	997.11	2,775.54	40.72	3,813.37
	Subtotal	637,878.56	83,915.60	41,102.08	15,824.32	778,720.55
<u>Business Interruption Loss</u>						
	Income	87.21	7,935.74	356.98	179.02	8,558.95
	Relocation	47,664.07	9,158.75	1,380.15	2,041.06	60,244.03
	Rental	23,781.60	5,447.29	262.99	272.63	29,764.51
	Wage	205.54	8,681.97	588.73	940.10	10,416.34
	Subtotal	71,738.42	31,223.76	2,588.85	3,432.81	108,983.83
<u>Total</u>						
	Total	709,616.98	115,139.36	43,690.92	19,257.13	887,704.39

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 3,479 buildings will be at least moderately damaged. This is over 21% of the total number of buildings in the region. There are an estimated 238 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	16	41.44	12	30.84	6	16.65	4	9.14	1	1.93
Commercial	435	46.03	238	25.13	192	20.32	80	8.41	1	0.11
Education	11	47.17	6	25.85	5	20.39	2	6.59	0	0.00
Government	13	47.26	7	24.98	6	20.88	2	6.88	0	0.00
Industrial	136	45.47	72	23.96	63	21.03	27	8.91	2	0.63
Religion	30	46.63	19	30.24	12	18.11	3	5.02	0	0.00
Residential	6,493	43.77	5,268	35.51	2,476	16.69	364	2.46	234	1.58
Total	7,135		5,622		2,760		481		238	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	110	41.79	63	24.11	74	28.04	16	6.07	0	0.00
Masonry	748	40.31	463	24.96	549	29.59	85	4.55	11	0.58
MH	39	85.66	3	5.87	2	5.48	0	0.60	1	2.39
Steel	333	45.49	157	21.44	167	22.88	74	10.06	1	0.14
Wood	6,027	45.21	5,058	37.94	1,706	12.80	311	2.33	230	1.72

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 0.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	1	0
Police Stations	1	0	0	1
Schools	17	7	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 64,395 tons of debris will be generated. Of the total amount, 4,091 tons (6%) is Other Tree Debris. Of the remaining 60,304 tons, Brick/Wood comprises 72% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1754 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 16,444 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,114 households to be displaced due to the hurricane. Of these, 286 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 419.5 million dollars, which represents 10.61 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 420 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 82% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	233,315.90	23,418.73	9,717.47	4,536.84	270,988.94
	Content	74,468.96	11,781.02	7,633.46	2,208.62	96,092.06
	Inventory	0.00	416.59	1,254.67	20.51	1,691.77
	Subtotal	307,784.86	35,616.34	18,605.61	6,765.96	368,772.77
<u>Business Interruption Loss</u>						
	Income	15.43	1,492.82	141.28	152.10	1,801.62
	Relocation	24,332.94	4,451.26	723.24	972.18	30,479.62
	Rental	12,948.69	2,438.67	125.86	121.13	15,634.35
	Wage	36.37	1,710.92	232.27	874.10	2,853.66
	Subtotal	37,333.43	10,093.67	1,222.65	2,119.51	50,769.25
<u>Total</u>						
	Total	345,118.29	45,710.01	19,828.25	8,885.47	419,542.02

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

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The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,062 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 29 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	28	70.92	8	19.36	2	6.32	1	3.02	0	0.38
Commercial	712	75.24	156	16.48	64	6.79	14	1.48	0	0.01
Education	18	76.57	4	17.05	1	5.87	0	0.51	0	0.00
Government	21	76.71	5	16.78	2	6.00	0	0.51	0	0.00
Industrial	224	74.96	50	16.58	20	6.82	5	1.51	0	0.12
Religion	49	76.01	12	18.60	3	4.98	0	0.41	0	0.00
Residential	10,572	71.26	3,316	22.35	870	5.86	49	0.33	29	0.19
Total	11,624		3,550		963		69		29	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	190	72.12	50	18.91	22	8.55	1	0.43	0	0.00
Masonry	1,241	66.88	346	18.66	251	13.52	16	0.86	2	0.09
MH	43	95.93	1	2.49	1	1.21	0	0.04	0	0.33
Steel	548	74.93	113	15.44	57	7.83	13	1.78	0	0.02
Wood	9,739	73.05	3,041	22.81	483	3.62	41	0.31	28	0.21

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	0	0
Police Stations	1	0	0	1
Schools	17	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 26,760 tons of debris will be generated. Of the total amount, 1,953 tons (7%) is Other Tree Debris. Of the remaining 24,807 tons, Brick/Wood comprises 66% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 657 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 8,385 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 291 households to be displaced due to the hurricane. Of these, 77 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 126.1 million dollars, which represents 3.19 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 126 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	81,024.64	5,579.75	2,382.08	1,073.44	90,059.91
	Content	17,415.84	2,009.59	1,598.29	344.54	21,368.26
	Inventory	0.00	78.39	279.60	5.54	363.52
	Subtotal	98,440.49	7,667.72	4,259.97	1,423.51	111,791.69
<u>Business Interruption Loss</u>						
	Income	0.00	625.36	33.55	131.38	790.29
	Relocation	5,631.27	1,118.36	181.43	219.71	7,150.78
	Rental	4,244.58	565.52	31.65	25.50	4,867.25
	Wage	0.00	676.81	55.13	747.63	1,479.57
	Subtotal	9,875.85	2,986.05	301.76	1,124.23	14,287.88
<u>Total</u>						
	Total	108,316.34	10,653.77	4,561.72	2,547.74	126,079.57

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 286 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	35	89.18	3	8.33	1	1.71	0	0.73	0	0.05
Commercial	863	91.27	65	6.92	15	1.56	2	0.25	0	0.00
Education	21	92.35	2	6.85	0	0.79	0	0.01	0	0.00
Government	26	92.17	2	6.97	0	0.84	0	0.02	0	0.00
Industrial	273	91.30	21	7.17	4	1.25	1	0.26	0	0.01
Religion	59	91.88	5	7.38	0	0.71	0	0.03	0	0.00
Residential	13,082	88.17	1,492	10.06	253	1.70	8	0.05	2	0.01
Total	14,359		1,590		273		11		2	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	236	89.84	23	8.75	4	1.39	0	0.01	0	0.00
Masonry	1,569	84.55	189	10.19	94	5.06	4	0.19	0	0.01
MH	45	99.31	0	0.53	0	0.13	0	0.00	0	0.03
Steel	667	91.25	49	6.71	13	1.74	2	0.29	0	0.00
Wood	11,935	89.52	1,291	9.68	99	0.74	6	0.04	2	0.02

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	0	0
Police Stations	1	0	0	1
Schools	17	0	0	14

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 12,054 tons of debris will be generated. Of the total amount, 980 tons (8%) is Other Tree Debris. Of the remaining 11,074 tons, Brick/Wood comprises 62% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 273 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,249 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 88 households to be displaced due to the hurricane. Of these, 24 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 47.1 million dollars, which represents 1.19 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 47 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	34,224.31	1,500.66	538.66	277.89	36,541.52
	Content	5,330.99	305.99	263.31	44.07	5,944.36
	Inventory	0.00	12.18	49.27	1.09	62.54
	Subtotal	39,555.30	1,818.82	851.24	323.06	42,548.42
<u>Business Interruption Loss</u>						
	Income	0.00	202.70	7.17	46.84	256.72
	Relocation	1,658.43	279.05	30.58	45.60	2,013.66
	Rental	1,715.07	145.81	6.13	5.48	1,872.49
	Wage	0.00	238.69	11.78	206.78	457.26
	Subtotal	3,373.50	866.25	55.67	304.70	4,600.12
<u>Total</u>						
	Total	42,928.81	2,685.07	906.91	627.75	47,148.54

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 38 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	38	98.08	1	1.70	0	0.17	0	0.05	0	0.00
Commercial	930	98.34	14	1.47	2	0.18	0	0.01	0	0.00
Education	23	98.46	0	1.51	0	0.03	0	0.00	0	0.00
Government	28	98.44	0	1.54	0	0.02	0	0.00	0	0.00
Industrial	294	98.25	5	1.66	0	0.07	0	0.01	0	0.00
Religion	63	98.56	1	1.40	0	0.04	0	0.00	0	0.00
Residential	14,494	97.69	306	2.06	35	0.24	1	0.01	0	0.00
Total	15,870		327		37		1		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	257	97.87	5	2.09	0	0.04	0	0.00	0	0.00
Masonry	1,779	95.88	61	3.27	15	0.83	0	0.02	0	0.00
MH	45	99.96	0	0.03	0	0.01	0	0.00	0	0.00
Steel	718	98.25	11	1.57	1	0.17	0	0.01	0	0.00
Wood	13,102	98.28	220	1.65	9	0.07	1	0.01	0	0.00

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 200 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	1	0	1
Police Stations	1	0	0	1
Schools	17	0	0	17

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3,381 tons of debris will be generated. Of the total amount, 287 tons (8%) is Other Tree Debris. Of the remaining 3,094 tons, Brick/Wood comprises 54% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 67 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,417 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 6 households to be displaced due to the hurricane. Of these, 2 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 13.0 million dollars, which represents 0.33 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 13 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 97% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	10,201.96	262.50	76.40	47.68	10,588.54
	Content	1,519.45	23.55	6.31	0.38	1,549.69
	Inventory	0.00	0.93	1.35	0.05	2.33
	Subtotal	11,721.41	286.98	84.06	48.11	12,140.56
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	443.34	9.88	0.47	0.35	454.04
	Rental	408.87	0.00	0.00	0.00	408.87
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	852.21	9.88	0.47	0.35	862.90
<u>Total</u>						
	Total	12,573.62	296.86	84.53	48.45	13,003.46

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	39	99.79	0	0.21	0	0.00	0	0.00	0	0.00
Commercial	943	99.73	3	0.27	0	0.00	0	0.00	0	0.00
Education	23	99.70	0	0.30	0	0.00	0	0.00	0	0.00
Government	28	99.69	0	0.31	0	0.00	0	0.00	0	0.00
Industrial	298	99.68	1	0.32	0	0.00	0	0.00	0	0.00
Religion	64	99.77	0	0.23	0	0.00	0	0.00	0	0.00
Residential	14,815	99.86	20	0.14	1	0.01	0	0.00	0	0.00
Total	16,210		24		1		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	262	99.60	1	0.40	0	0.00	0	0.00	0	0.00
Masonry	1,846	99.47	9	0.51	0	0.02	0	0.00	0	0.00
MH	45	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	729	99.68	2	0.32	0	0.00	0	0.00	0	0.00
Wood	13,326	99.96	5	0.04	1	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 200 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	17	0	0	17

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 218 tons of debris will be generated. Of the total amount, 18 tons (8%) is Other Tree Debris. Of the remaining 200 tons, Brick/Wood comprises 42% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 116 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.9 million dollars, which represents 0.02 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	718.79	0.00	0.00	0.00	718.79
	Content	161.77	0.00	0.00	0.00	161.77
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	880.56	0.00	0.00	0.00	880.56
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	1.78	0.00	0.00	0.00	1.78
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	1.78	0.00	0.00	0.00	1.78
<u>Total</u>						
	Total	882.34	0.00	0.00	0.00	882.34

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Hurricane Event Report

Region Name: West_Haven_Hurricane

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, March 07, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 10.99 square miles and contains 11 census tracts. There are over 21 thousand households in the region and has a total population of 52,360 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 16 thousand buildings in the region with a total building replacement value (excluding contents) of 3,953 million dollars (2006 dollars). Approximately 91% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 16,235 buildings in the region which have an aggregate total replacement value of 3,953 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	3,035,267	76.8%
Commercial	593,965	15.0%
Industrial	195,786	5.0%
Agricultural	5,250	0.1%
Religious	55,859	1.4%
Government	27,295	0.7%
Education	39,498	1.0%
Total	3,952,920	100.0%

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 200 beds. There are 17 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	39	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	946	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	23	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	28	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	299	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	64	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	14,836	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	16,235		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	263	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,856	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	45	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	731	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	13,332	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 200 hospital beds available for use. On the day of the hurricane, the model estimates that 200 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	0	3
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	17	0	0	17

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 52,360) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	52,360	3,035,267	917,653	3,952,920
Total	52,360	3,035,267	917,653	3,952,920
Study Region Total	52,360	3,035,267	917,653	3,952,920

Hazus-MH: Earthquake Event Report

Region Name: Woodbridge_EQ

Earthquake Scenario: Woodbridge_Annualized

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 19.19 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,983 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,082 (millions of dollars). Approximately 89.00 % of the buildings (and 77.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 438 and 38 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 1,082 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 86% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 5 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 4 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 476.00 (millions of dollars). This inventory includes over 62 kilometers of highways, 10 bridges, 333 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	10	35.70
	Segments	10	402.50
	Tunnels	1	0.30
	Subtotal		438.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			438.50

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3.30
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		41.60
Waste Water	Distribution Lines	NA	2.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.00
Natural Gas	Distribution Lines	NA	1.30
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.30
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			45.00

Earthquake Scenario

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

Scenario Name	Woodbridge_Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Total										

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	5	0	0	0
EOCs	0	0	0	0
PoliceStations	1	0	0	0
FireStations	1	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	10	0	0	0	0
	Bridges	10	0	0	0	0
	Tunnels	1	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	167	0	0
Waste Water	100	0	0
Natural Gas	67	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	3,103	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 13 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 67 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	402.51	\$0.00	0.00
	Bridges	35.67	\$0.00	0.00
	Tunnels	0.34	\$0.00	0.00
	Subtotal	438.50	0.00	
Railways	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	438.50	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	41.63	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.00	\$0.00	0.00
	Subtotal	2.00	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.30	\$0.00	0.00
	Subtotal	1.33	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	44.96	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	8,983	831	251	1,082
Total State		8,983	831	251	1,082
Total Region		8,983	831	251	1,082

Hazus-MH: Earthquake Event Report

Region Name: Woodbridge_EQ

Earthquake Scenario: Woodbridge_Probabilistic_100yr_MM_7

Print Date: January 15, 2013

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

Disclaimer:

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 earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:

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

The geographical size of the region is 19.19 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,983 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,082 (millions of dollars). Approximately 89.00 % of the buildings (and 77.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 438 and 38 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 1,082 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 86% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 5 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 4 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 476.00 (millions of dollars). This inventory includes over 62 kilometers of highways, 10 bridges, 333 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	10	35.70
	Segments	10	402.50
	Tunnels	1	0.30
	Subtotal		438.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		0.00
Total			438.50

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3.30
	Facilities	1	38.30
	Pipelines	0	0.00
	Subtotal		41.60
Waste Water	Distribution Lines	NA	2.00
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		2.00
Natural Gas	Distribution Lines	NA	1.30
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		1.30
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	0	0.00
	Subtotal		0.00
Total			45.00

Earthquake Scenario

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

Scenario Name	Woodbridge_Probabilistic_100yr_MM_7
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18	0.51	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	254	7.23	0	0.00	0	0.00	0	0.00	0	0.00
Education	7	0.20	0	0.00	0	0.00	0	0.00	0	0.00
Government	5	0.14	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	74	2.11	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	176	5.01	0	0.00	0	0.00	0	0.00	0	0.00
Religion	22	0.63	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	2,958	84.18	0	0.00	0	0.00	0	0.00	0	0.00
Total	3,514		0		0		0		0	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	3,020	85.93	0	0.00	0	0.00	0	0.00	0	0.00
Steel	172	4.88	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	30	0.86	0	0.00	0	0.00	0	0.00	0	0.00
Precast	12	0.33	0	0.00	0	0.00	0	0.00	0	0.00
RM	45	1.28	0	0.00	0	0.00	0	0.00	0	0.00
URM	233	6.62	0	0.00	0	0.00	0	0.00	0	0.00
MH	3	0.09	0	0.00	0	0.00	0	0.00	0	0.00
Total	3,514		0		0		0		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	5	0	0	5
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	10	0	0	10	10
	Bridges	10	0	0	10	10
	Tunnels	1	0	0	1	1
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	0	0	1	1
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	167	0	0
Waste Water	100	0	0
Natural Gas	67	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	3,103	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	0	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.00	0.00	0.00

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	402.51	\$0.00	0.00
	Bridges	35.67	\$0.00	0.00
	Tunnels	0.34	\$0.00	0.00
	Subtotal	438.50	0.00	
Railways	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	0.00	\$0.00	0.00
	Runways	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
	Total	438.50	0.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	38.30	\$0.00	0.00
	Distribution Lines	3.30	\$0.00	0.00
	Subtotal	41.63	\$0.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	2.00	\$0.00	0.00
	Subtotal	2.00	\$0.00	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	1.30	\$0.00	0.00
	Subtotal	1.33	\$0.00	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
	Total	44.96	\$0.00	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

New Haven,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	New Haven	8,983	831	251	1,082
Total State		8,983	831	251	1,082
Total Region		8,983	831	251	1,082

Hazus-MH: Flood Event Report

Region Name: Woodbridge Riverine 100 year

Flood Scenario: Riverine 100 year

Print Date: Tuesday, January 29, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 19 square miles and contains 155 census blocks. The region contains over 3 thousand households and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 3,514 buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89.19% of the buildings (and 76.78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 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	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religion	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	427,610	75.6%
Commercial	105,339	18.6%
Industrial	13,035	2.3%
Agricultural	5,729	1.0%
Religion	7,002	1.2%
Government	4,096	0.7%
Education	2,786	0.5%
Total	565,597	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire station, 1 police station 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:	Woodbridge Riverine 100 year
Scenario Name:	Riverine 100 year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	5	1	0	0

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.

The model estimates that a total of 371 tons of debris will be generated. Of the total amount, Finishes comprises 72% of the total, Structure comprises 17% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 15 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 113 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 148 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 9.10 million dollars, which represents 1.61 % 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 9.04 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.00% 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	2.42	0.86	0.20	0.30	3.78
	Content	1.40	2.22	0.46	0.98	5.07
	Inventory	0.00	0.02	0.06	0.12	0.19
	Subtotal	3.82	3.10	0.72	1.40	9.04
<u>Business Interruption</u>						
	Income	0.00	0.03	0.00	0.00	0.03
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.02	0.00	0.01	0.02
	Subtotal	0.00	0.05	0.00	0.01	0.05
ALL	Total	3.82	3.15	0.72	1.41	9.10

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Total Study Region	8,983	831,461	251,434	1,082,895

Direct Economic Losses for Utilities

January 29, 2013

All values are in thousands of dollars.

	Potable Water	Waste Water	Oil Systems	Natural Gas	Electric Power	Communication	Total
Connecticut							
New Haven							
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Pipelines	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Scenario Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge Riverine 100 year
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Loss For Transportation

January 29, 2013

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Connecticut								
New Haven								
Segments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Bridges	\$6.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.20
Tunnels	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Facilities	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$6.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.20
Total	\$6.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.20
Scenario Total	\$6.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$6.20

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge Riverine 100 year
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Losses for Buildings

January 29, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	3,782	5,067	194	0.70	2	26	24	1	9,096
Total	3,782	5,067	194	0.70	2	26	24	1	9,096
Scenario Total	3,782	5,067	194	0.70	2	26	24	1	9,096

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge Riverine 100 year
 Scenario: Riverine 100 year
 Return Period: 100

Direct Economic Loss For Agriculture Products

January 29, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
ALFALFA HAY	0.00	27,177.51	27,177.51	27,177.51	27,177.51
CORN SILAGE	0.00	98,532.18	131,376.24	131,376.24	131,376.24
Total	0.00	125,709.68	158,553.74	158,553.74	158,553.74
Total	0.00	125,709.68	158,553.74	158,553.74	158,553.74
Scenario Total	0.00	125,709.68	158,553.74	158,553.74	158,553.74

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge Riverine 100 year
Scenario: Riverine 100 year
Return Period: 100

Direct Economic Annualized Losses for Buildings

January 29, 2013

All values are in thousands of dollars

		Capital Stock Losses			Income Losses					
		Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Connecticut										
	New Haven	3,782	5,067	194	0.7	2	26	24	1	9,096
	Total	3,782	5,067	194	0.7	2	26	24	1	9,096
Scenario Total		3,782	5,067	194	0.7	2	26	24	1	9,096

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge Riverine 100 year
 Scenario: Riverine 100 year
 Return Period: 100

Hazus-MH: Flood Event Report

Region Name: Woodbridge 500 year riverine

Flood Scenario: 500 year riverine

Print Date: Thursday, January 31, 2013

Disclaimer:

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

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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):

- Connecticut

Note:

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

The geographical size of the region is 19 square miles and contains 155 census blocks. The region contains over 3 thousand households and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 3,514 buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89.19% of the buildings (and 76.78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 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	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religion	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure (\$1000)	Percent of Total
Residential	253,673	70.0%
Commercial	86,776	24.0%
Industrial	10,723	3.0%
Agricultural	5,712	1.6%
Religion	1,745	0.5%
Government	0	0.0%
Education	3,685	1.0%
Total	362,314	100.00%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire station, 1 police station 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:	Woodbridge 500 year riverine
Scenario Name:	500 year riverine
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	0		0		0		0		0		0	

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	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	5	0	0	0

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.

The model estimates that a total of 2 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the flood.

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 15 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 2 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 0.03 million dollars, which represents 0.01 % 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 0.03 million dollars. 21% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 20.59% 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	0.01	0.00	0.00	0.00	0.01
	Content	0.00	0.02	0.00	0.00	0.02
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.01	0.02	0.00	0.00	0.03
<u>Business Interruption</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.01	0.00	0.00	0.01
ALL	Total	0.01	0.03	0.00	0.00	0.03

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Total Study Region	8,983	831,461	251,434	1,082,895

Direct Economic Loss For Agriculture Products

January 31, 2013

	Crop Loss Day 0	Crop Loss Day 3	Crop Loss Day 7	Crop Loss Day 14	Max Total Loss
Connecticut					
New Haven					
ALFALFA HAY	0.00	1,373.69	1,373.69	1,373.69	1,373.69
CORN SILAGE	0.00	3,202.12	4,269.49	4,269.49	4,269.49
Total	0.00	4,575.80	5,643.18	5,643.18	5,643.18
Total	0.00	4,575.80	5,643.18	5,643.18	5,643.18
Scenario Total	0.00	4,575.80	5,643.18	5,643.18	5,643.18

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge 500 year riverine
Scenario: 500 year riverine
Return Period: 500

Direct Economic Annualized Losses for Buildings

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses			Building Loss Ratio %	Income Losses				Total Loss
	Building Loss	Contents Loss	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	9	18	0	0.0	0	4	3	0	34
Total	9	18	0	0.0	0	4	3	0	34
Scenario Total	9	18	0	0.0	0	4	3	0	34

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: Woodbridge 500 year riverine
 Scenario: 500 year riverine
 Return Period: 500

Hazus-MH: Hurricane Event Report

Region Name: Woodbridge 1938

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Friday, February 01, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name: UN-NAMED-1938-4
Type: Historic
Max Peak Gust in Study Region: 108 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 140 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	14	75.45	3	17.21	1	4.75	0	2.29	0	0.29
Commercial	205	80.62	38	15.10	10	3.84	1	0.44	0	0.00
Education	6	82.42	1	14.33	0	3.12	0	0.14	0	0.00
Government	4	82.28	1	14.41	0	3.17	0	0.14	0	0.00
Industrial	60	80.91	10	14.10	3	3.96	1	0.95	0	0.09
Religion	18	80.85	4	16.20	1	2.81	0	0.14	0	0.00
Residential	2,344	74.79	667	21.28	114	3.64	6	0.19	3	0.11
Total	2,650		724		129		8		3	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	33	78.79	7	16.17	2	4.93	0	0.11	0	0.00
Masonry	216	76.50	47	16.84	17	5.99	2	0.59	0	0.08
MH	2	97.24	0	1.88	0	0.77	0	0.02	0	0.09
Steel	142	81.87	23	13.47	7	4.00	1	0.66	0	0.01
Wood	2,274	75.34	642	21.26	94	3.12	6	0.19	3	0.10

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 20,475 tons of debris will be generated. Of the total amount, 13,373 tons (65%) is Other Tree Debris. Of the remaining 7,102 tons, Brick/Wood comprises 29% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 83 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 5,019 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 10 households to be displaced due to the hurricane. Of these, 1 person (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 23.4 million dollars, which represents 2.16 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 23 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	15,113.74	1,266.94	203.82	354.46	16,938.95
	Content	3,743.31	273.87	107.38	89.88	4,214.43
	Inventory	0.00	5.29	17.95	5.40	28.64
	Subtotal	18,857.05	1,546.10	329.15	449.73	21,182.03
<u>Business Interruption Loss</u>						
	Income	0.00	217.31	2.99	44.00	264.30
	Relocation	720.72	237.92	15.46	64.69	1,038.79
	Rental	306.09	141.65	2.63	5.66	456.02
	Wage	0.00	201.02	5.07	231.20	437.30
	Subtotal	1,026.81	797.89	26.15	345.55	2,196.40
<u>Total</u>						
	Total	19,883.86	2,343.99	355.30	795.28	23,378.43

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Debris Summary Report:

February 01, 2013

All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	2,080	3	5,019	13,373	20,475
Total	2,080	3	5,019	13,373	20,475
Study Region Total	2,080	3	5,019	13,373	20,475

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings:

1646

February 1, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	16,939	4,214	29	1.56	1,039	264	437	456	23,378
Total	16,939	4,214	29	1.56	1,039	264	437	456	23,378
Study Region Total	16,939	4,214	29	1.56	1,039	264	437	456	23,378

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

January 31, 2013

Study Region : woodbridge probabilistic-annualized

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	19
Number of Census Tracts	2
Number of People in the Region	8,983
General Building Stock	

Occupancy	Building Count	Dollar Exposure (\$ K)
Residential	3,134	831,461
Commercial	254	179,320
Other	126	72,114
Total	3,514	1,082,895

Scenario Results**Number of Residential Buildings Damaged**

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	1	0	0	0	1
50	23	1	0	0	24
100	171	11	0	0	182
200	464	58	2	1	525
500	956	245	25	15	1,241
1000	1,191	467	91	59	1,808

Number of Buildings Damaged

Return Period	Minor	Moderate	Severe	Destruction	Total
10	0	0	0	0	0
20	2	0	0	0	2
50	26	1	0	0	27
100	184	13	0	0	197
200	501	65	3	1	570
500	1,043	283	32	15	1,373
1000	1,299	547	114	60	2,020

Shelter Requirements

Return Period	Displaced Households (#Households)	Short Term Shelter (#People)
10	0	0
20	0	0
50	0	0
100	0	0
200	4	1
500	32	6
1000	108	20

Economic Loss (x 1000)

ReturnPeriod	Property Damage (Capital Stock) Losses		Business Interruption (Income) Losses
	Residential	Total	
10	0	0	0
20	4	4	0
50	1,410	1,479	10
100	4,537	4,905	281
200	11,196	12,508	1,223
500	38,827	44,291	5,091
1000	89,614	102,965	11,603
Annualized	387	443	46

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 721 buildings will be at least moderately damaged. This is over 21% of the total number of buildings in the region. There are an estimated 60 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	7	39.46	6	32.40	3	17.50	2	8.88	0	1.76
Commercial	113	44.61	72	28.53	54	21.43	14	5.38	0	0.04
Education	3	46.12	2	26.99	2	21.65	0	5.24	0	0.00
Government	2	47.03	1	26.72	1	21.21	0	5.04	0	0.00
Industrial	33	44.42	19	25.54	16	21.90	6	7.55	0	0.59
Religion	10	45.37	7	32.07	4	18.60	1	3.96	0	0.00
Residential	1,326	42.30	1,191	38.01	467	14.89	91	2.91	59	1.89
Total	1,494		1,299		547		114		60	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	17	41.46	11	25.63	12	28.14	2	4.77	0	0.00
Masonry	118	42.01	79	27.94	67	23.82	15	5.36	2	0.87
MH	2	85.03	0	6.53	0	6.09	0	0.65	0	1.70
Steel	79	45.38	42	24.19	40	23.22	12	7.13	0	0.08
Wood	1,292	42.78	1,180	39.07	408	13.53	84	2.78	55	1.84

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 62,015 tons of debris will be generated. Of the total amount, 39,067 tons (63%) is Other Tree Debris. Of the remaining 22,948 tons, Brick/Wood comprises 35% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 329 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 14,727 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 108 households to be displaced due to the hurricane. Of these, 20 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 114.6 million dollars, which represents 10.58 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 115 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	64,280.54	6,329.52	1,114.93	1,659.00	73,384.00
	Content	25,333.15	2,608.94	762.77	688.85	29,393.70
	Inventory	0.00	42.61	118.69	25.83	187.13
	Subtotal	89,613.69	8,981.07	1,996.38	2,373.68	102,964.83
<u>Business Interruption Loss</u>						
	Income	10.22	454.76	13.96	51.74	530.68
	Relocation	5,823.72	1,244.18	96.13	322.70	7,486.74
	Rental	2,003.65	709.02	13.60	28.91	2,755.18
	Wage	24.10	461.45	23.34	321.89	830.78
	Subtotal	7,861.69	2,869.41	147.03	725.25	11,603.38
<u>Total</u>						
	Total	97,475.38	11,850.48	2,143.41	3,098.93	114,568.21

Appendix A: County Listing for the Region

Connecticut
- New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 329 buildings will be at least moderately damaged. This is over 9% of the total number of buildings in the region. There are an estimated 15 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	11	59.95	5	25.42	2	9.44	1	4.50	0	0.69
Commercial	166	65.52	59	23.17	25	9.89	4	1.41	0	0.01
Education	5	67.20	2	22.31	1	9.52	0	0.97	0	0.00
Government	3	66.49	1	22.52	0	9.95	0	1.04	0	0.00
Industrial	49	65.85	16	21.33	8	10.17	2	2.43	0	0.22
Religion	14	65.75	6	25.23	2	8.26	0	0.76	0	0.00
Residential	1,893	60.40	956	30.49	245	7.83	25	0.80	15	0.47
Total	2,141		1,043		283		32		15	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	26	62.58	10	23.21	6	13.40	0	0.82	0	0.00
Masonry	173	61.41	68	23.96	36	12.74	5	1.64	1	0.26
MH	2	93.66	0	3.73	0	2.17	0	0.10	0	0.33
Steel	115	66.68	36	20.59	19	10.70	3	2.01	0	0.02
Wood	1,842	61.03	932	30.87	207	6.86	24	0.79	14	0.46

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 39,714 tons of debris will be generated. Of the total amount, 26,008 tons (65%) is Other Tree Debris. Of the remaining 13,706 tons, Brick/Wood comprises 29% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 159 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 9,732 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 32 households to be displaced due to the hurricane. Of these, 6 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 49.4 million dollars, which represents 4.56 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 49 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	29,363.35	2,767.61	469.24	770.46	33,370.66
	Content	9,463.19	848.83	284.07	251.01	10,847.10
	Inventory	0.00	15.74	45.33	12.34	73.41
	Subtotal	38,826.54	3,632.17	798.64	1,033.81	44,291.17
<u>Business Interruption Loss</u>						
	Income	0.86	260.74	5.67	51.17	318.44
	Relocation	2,244.24	543.83	40.21	148.14	2,976.42
	Rental	830.90	308.19	5.89	13.07	1,158.04
	Wage	2.03	258.95	9.60	367.70	638.28
	Subtotal	3,078.04	1,371.70	61.36	580.08	5,091.18
<u>Total</u>						
	Total	41,904.58	5,003.87	860.01	1,613.89	49,382.35

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 69 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	15	84.23	2	11.71	0	2.65	0	1.29	0	0.12
Commercial	224	88.09	25	9.90	5	1.80	1	0.21	0	0.00
Education	6	89.49	1	9.29	0	1.19	0	0.04	0	0.00
Government	4	89.14	0	9.57	0	1.25	0	0.04	0	0.00
Industrial	65	88.41	7	9.28	1	1.80	0	0.48	0	0.03
Religion	19	88.35	2	10.51	0	1.09	0	0.05	0	0.00
Residential	2,609	83.26	464	14.79	58	1.87	2	0.05	1	0.03
Total	2,944		501		65		3		1	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	36	86.77	5	11.06	1	2.14	0	0.03	0	0.00
Masonry	238	84.56	33	11.76	9	3.35	1	0.30	0	0.03
MH	2	98.85	0	0.86	0	0.26	0	0.00	0	0.02
Steel	154	89.09	15	8.78	3	1.81	1	0.31	0	0.00
Wood	2,528	83.74	442	14.64	46	1.53	2	0.06	1	0.02

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 12,555 tons of debris will be generated. Of the total amount, 8,173 tons (65%) is Other Tree Debris. Of the remaining 4,382 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 53 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 3,065 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 4 households to be displaced due to the hurricane. Of these, 1 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 13.7 million dollars, which represents 1.27 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 14 million dollars. 3% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 85% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	9,499.73	754.64	108.67	204.21	10,567.24
	Content	1,696.77	136.36	50.52	42.83	1,926.48
	Inventory	0.00	2.49	8.54	2.79	13.81
	Subtotal	11,196.50	893.48	167.72	249.83	12,507.53
<u>Business Interruption Loss</u>						
	Income	0.00	149.76	1.76	26.26	177.78
	Relocation	316.31	137.67	7.50	34.77	496.25
	Rental	163.37	86.04	1.46	3.20	254.07
	Wage	0.00	136.39	2.98	155.63	295.00
	Subtotal	479.68	509.86	13.71	219.84	1,223.10
<u>Total</u>						
	Total	11,676.18	1,403.34	181.44	469.68	13,730.63

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 13 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	17	94.71	1	4.31	0	0.68	0	0.29	0	0.01
Commercial	244	96.11	9	3.47	1	0.39	0	0.03	0	0.00
Education	7	96.69	0	3.20	0	0.11	0	0.00	0	0.00
Government	5	96.79	0	3.11	0	0.10	0	0.00	0	0.00
Industrial	71	96.14	3	3.43	0	0.32	0	0.09	0	0.00
Religion	21	96.48	1	3.39	0	0.12	0	0.01	0	0.00
Residential	2,952	94.18	171	5.45	11	0.37	0	0.00	0	0.00
Total	3,317		184		13		0		0	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	40	95.60	2	4.15	0	0.25	0	0.00	0	0.00
Masonry	266	94.27	13	4.77	3	0.90	0	0.06	0	0.00
MH	2	99.83	0	0.14	0	0.03	0	0.00	0	0.00
Steel	167	96.47	5	3.16	1	0.33	0	0.04	0	0.00
Wood	2,852	94.47	159	5.26	8	0.26	0	0.01	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	5

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 8,459 tons of debris will be generated. Of the total amount, 5,792 tons (68%) is Other Tree Debris. Of the remaining 2,667 tons, Brick/Wood comprises 18% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 19 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,191 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 5.2 million dollars, which represents 0.48 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 5 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	4,176.97	240.38	27.91	57.38	4,502.65
	Content	359.65	27.85	6.54	6.17	400.21
	Inventory	0.00	0.43	1.23	0.38	2.04
	Subtotal	4,536.62	268.67	35.68	63.93	4,904.89
<u>Business Interruption Loss</u>						
	Income	0.00	26.82	0.17	9.55	36.54
	Relocation	105.66	21.27	0.87	6.29	134.09
	Rental	61.27	12.90	0.17	0.59	74.93
	Wage	0.00	12.89	0.28	22.46	35.62
	Subtotal	166.92	73.88	1.50	38.88	281.18
<u>Total</u>						
	Total	4,703.54	342.54	37.18	102.81	5,186.07

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
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New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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General Building Stock

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Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18	99.12	0	0.81	0	0.05	0	0.01	0	0.00
Commercial	252	99.09	2	0.86	0	0.05	0	0.00	0	0.00
Education	7	99.12	0	0.87	0	0.01	0	0.00	0	0.00
Government	5	99.13	0	0.86	0	0.01	0	0.00	0	0.00
Industrial	73	99.05	1	0.92	0	0.02	0	0.00	0	0.00
Religion	22	99.27	0	0.71	0	0.02	0	0.00	0	0.00
Residential	3,110	99.24	23	0.74	1	0.02	0	0.00	0	0.00
Total	3,487		26		1		0		0	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	41	98.80	0	1.19	0	0.01	0	0.00	0	0.00
Masonry	278	98.66	3	1.23	0	0.11	0	0.00	0	0.00
MH	2	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	171	99.05	2	0.91	0	0.04	0	0.00	0	0.00
Wood	2,999	99.34	19	0.64	0	0.01	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	5

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 729 tons of debris will be generated. Of the total amount, 445 tons (61%) is Other Tree Debris. Of the remaining 284 tons, Brick/Wood comprises 41% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 5 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 169 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 1.5 million dollars, which represents 0.14 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 95% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	1,347.99	51.72	5.52	11.98	1,417.20
	Content	61.81	0.00	0.00	0.00	61.81
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	1,409.79	51.72	5.52	11.98	1,479.01
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	3.92	0.62	0.02	0.08	4.64
	Rental	5.11	0.00	0.00	0.00	5.11
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	9.03	0.62	0.02	0.08	9.75
<u>Total</u>						
	Total	1,418.82	52.34	5.54	12.06	1,488.76

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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 Hurricane. These results can be improved by using enhanced inventory data.

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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 and the National Institute of Building Sciences. 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:

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

The geographical size of the region is 19.20 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,983 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 1,083 million dollars (2006 dollars). Approximately 89% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,514 buildings in the region which have an aggregate total replacement value of 1,083 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	831,461	76.8%
Commercial	179,320	16.6%
Industrial	26,053	2.4%
Agricultural	7,392	0.7%
Religious	25,517	2.4%
Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18	99.83	0	0.17	0	0.00	0	0.00	0	0.00
Commercial	253	99.78	1	0.22	0	0.00	0	0.00	0	0.00
Education	7	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Government	5	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Industrial	74	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Religion	22	99.81	0	0.19	0	0.00	0	0.00	0	0.00
Residential	3,133	99.97	1	0.03	0	0.00	0	0.00	0	0.00
Total	3,512		2		0		0		0	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	42	99.69	0	0.31	0	0.00	0	0.00	0	0.00
Masonry	281	99.75	1	0.25	0	0.00	0	0.00	0	0.00
MH	2	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	173	99.75	0	0.25	0	0.00	0	0.00	0	0.00
Wood	3,019	99.99	0	0.01	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	5

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 1 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	3.68	0.00	0.00	0.00	3.68
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	3.68	0.00	0.00	0.00	3.68
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.03	0.00	0.00	0.00	0.03
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.03	0.00	0.00	0.00	0.03
<u>Total</u>						
	Total	3.70	0.00	0.00	0.00	3.70

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Hazus-MH: Hurricane Event Report

Region Name: woodbridge probabilistic-annualized

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Thursday, January 31, 2013

Disclaimer:

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General Description of the Region

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Note:

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

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Agricultural	7,392	0.7%
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Government	6,866	0.6%
Education	6,286	0.6%
Total	1,082,895	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	254	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	7	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	5	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	74	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	22	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	3,134	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	3,514		0		0		0		0	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	42	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	282	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	2	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	173	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	3,019	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	5

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,983) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates
(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Business Interruption Loss</u>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.00	0.00	0.00	0.00	0.00
<u>Total</u>						
	Total	0.00	0.00	0.00	0.00	0.00

Appendix A: County Listing for the Region

- Connecticut
 - New Haven

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
New Haven	8,983	831,461	251,434	1,082,895
Total	8,983	831,461	251,434	1,082,895
Study Region Total	8,983	831,461	251,434	1,082,895

Debris Summary Report: 10 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	0	0	0	0	0
Total	0	0	0	0	0
Study Region Total	0	0	0	0	0

Debris Summary Report: 20 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1	0	0	0	1
Total	1	0	0	0	1
Study Region Total	1	0	0	0	1

Debris Summary Report: 50 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	115	0	169	445	729
Total	115	0	169	445	729
Study Region Total	115	0	169	445	729

Debris Summary Report: 100 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	476	0	2,191	5,792	8,459
Total	476	0	2,191	5,792	8,459
Study Region Total	476	0	2,191	5,792	8,459

Debris Summary Report: 200 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	1,316	1	3,065	8,173	12,555
Total	1,316	1	3,065	8,173	12,555
Study Region Total	1,316	1	3,065	8,173	12,555

Debris Summary Report: 500 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	3,951	23	9,732	26,008	39,714
Total	3,951	23	9,732	26,008	39,714
Study Region Total	3,951	23	9,732	26,008	39,714

Debris Summary Report: 1000 - year Event

January 31, 2013 All values are in tons.

	Brick, Wood and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
Connecticut					
New Haven	8,145	76	14,727	39,067	62,015
Total	8,145	76	14,727	39,067	62,015
Study Region Total	8,145	76	14,727	39,067	62,015

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Direct Economic Losses For Buildings: Annualized Losses

1732

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	333	109	1	0.03	26	4	6	10	489
Total	333	109	1	0.03	26	4	6	10	489
Study Region Total	333	109	1	0.03	26	4	6	10	489

Direct Economic Losses For Buildings: 10 - year Event

1733

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	0	0	0	0.00	0	0	0	0	0
Total	0	0	0	0.00	0	0	0	0	0
Study Region Total	0	0	0	0.00	0	0	0	0	0

Direct Economic Losses For Buildings: 20 - year Event

1734

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	4	0	0	0.00	0	0	0	0	4
Total	4	0	0	0.00	0	0	0	0	4
Study Region Total	4	0	0	0.00	0	0	0	0	4

Direct Economic Losses For Buildings: 50 - year Event

1735

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	1,417	62	0	0.13	5	0	0	5	1,489
Total	1,417	62	0	0.13	5	0	0	5	1,489
Study Region Total	1,417	62	0	0.13	5	0	0	5	1,489

Direct Economic Losses For Buildings: 100 - year Event

1736

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	4,503	400	2	0.42	134	37	36	75	5,186
Total	4,503	400	2	0.42	134	37	36	75	5,186
Study Region Total	4,503	400	2	0.42	134	37	36	75	5,186

Direct Economic Losses For Buildings: 200 - year Event

1737

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	10,567	1,926	14	0.98	496	178	295	254	13,731
Total	10,567	1,926	14	0.98	496	178	295	254	13,731
Study Region Total	10,567	1,926	14	0.98	496	178	295	254	13,731

Direct Economic Losses For Buildings: 500 - year Event

1738

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	33,371	10,847	73	3.08	2,976	318	638	1,158	49,382
Total	33,371	10,847	73	3.08	2,976	318	638	1,158	49,382
Study Region Total	33,371	10,847	73	3.08	2,976	318	638	1,158	49,382

Direct Economic Losses For Buildings: 1000 - year Event

1739

January 31, 2013

All values are in thousands of dollars

	Capital Stock Losses				Income Losses				Total Loss
	Cost Building Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Connecticut									
New Haven	73,384	29,394	187	6.78	7,487	531	831	2,755	114,568
Total	73,384	29,394	187	6.78	7,487	531	831	2,755	114,568
Study Region Total	73,384	29,394	187	6.78	7,487	531	831	2,755	114,568

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region : woodbridge probabilistic-annualized
 Scenario : Probabilistic