



## Hazus: Flood Global Risk Report

**Region Name:** DeepRiver

**Flood Scenario:** DeepRiverAll

**Print Date:** Wednesday, January 8, 2020

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

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



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## General Description of the Region

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

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

- Connecticut

**Note:**

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

The geographical size of the region is approximately 14 square miles and contains 135 census blocks. The region contains over 2 thousand households and has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 1,997 buildings in the region with a total building replacement value (excluding contents) of 819 million dollars. Approximately 89.43% of the buildings (and 65.26% of the building value) are associated with residential housing.



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## Building Inventory

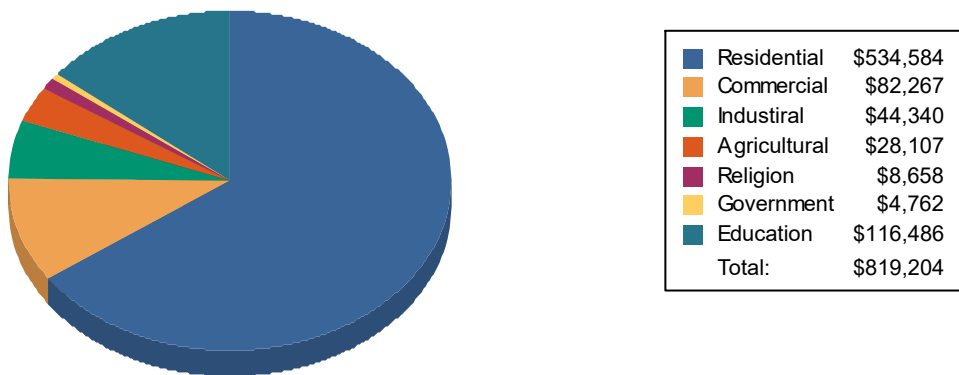
### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million 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	534,584	65.3%
Commercial	82,267	10.0%
Industrial	44,340	5.4%
Agricultural	28,107	3.4%
Religion	8,658	1.1%
Government	4,762	0.6%
Education	116,486	14.2%
<b>Total</b>	<b>819,204</b>	<b>100%</b>

**Building Exposure by Occupancy Type for the Study Region**  
**(\$1000's)**



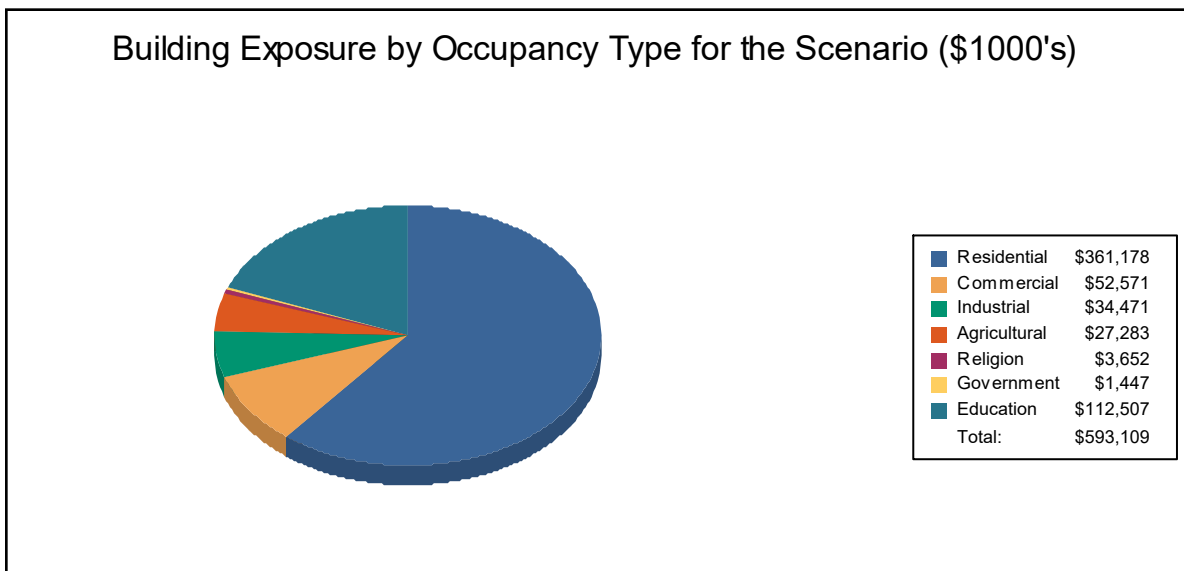
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	361,178	60.9%
Commercial	52,571	8.9%
Industrial	34,471	5.8%
Agricultural	27,283	4.6%
Religion	3,652	0.6%
Government	1,447	0.2%
Education	112,507	19.0%
<b>Total</b>	<b>593,109</b>	<b>100%</b>



### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.  
There are 4 schools, 2 fire stations, 1 police station and 1 emergency operation center.



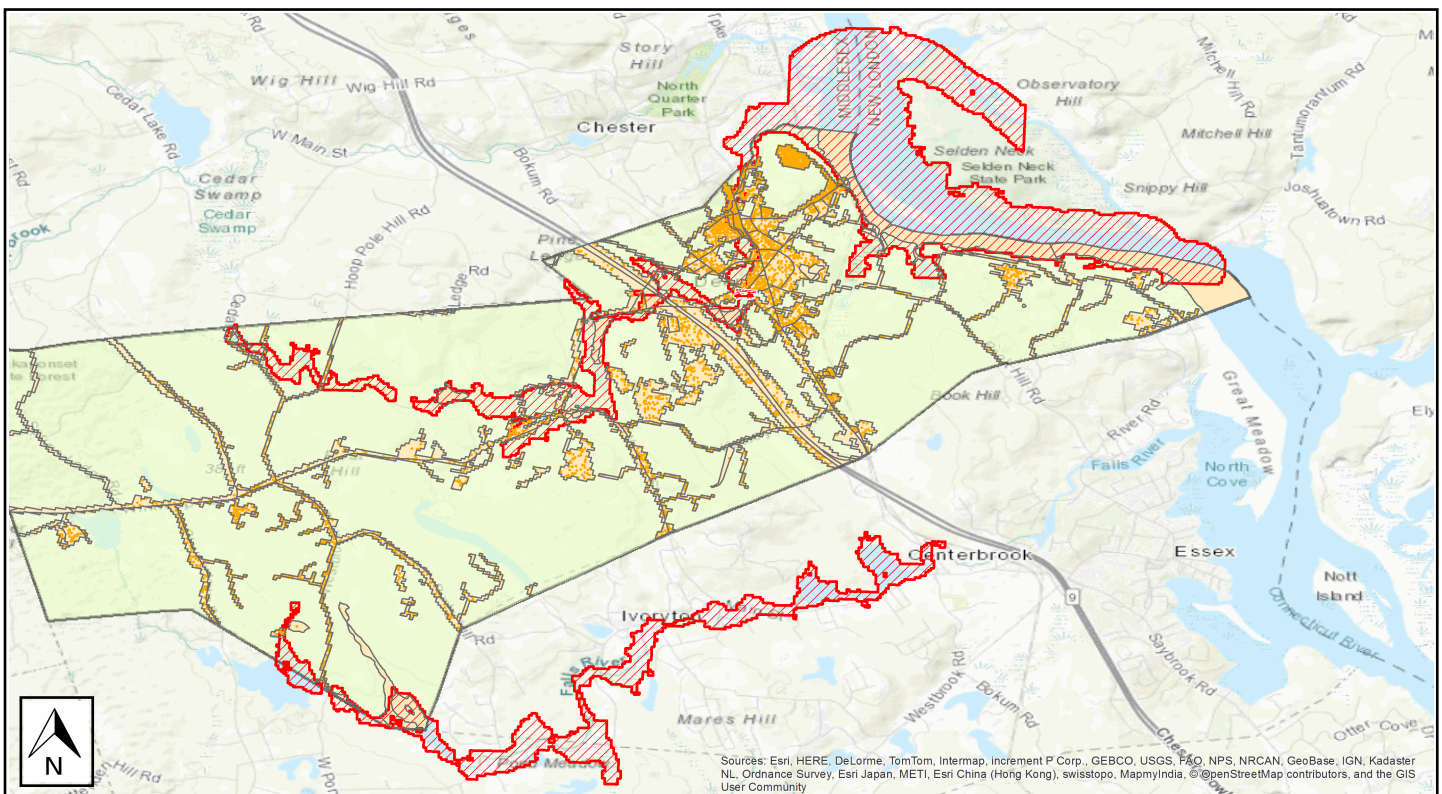
## Flood Scenario Parameters

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

<b>Study Region Name:</b>	DeepRiver
<b>Scenario Name:</b>	DeepRiverAll
<b>Return Period Analyzed:</b>	10
<b>Analysis Options Analyzed:</b>	No What-Ifs

### Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



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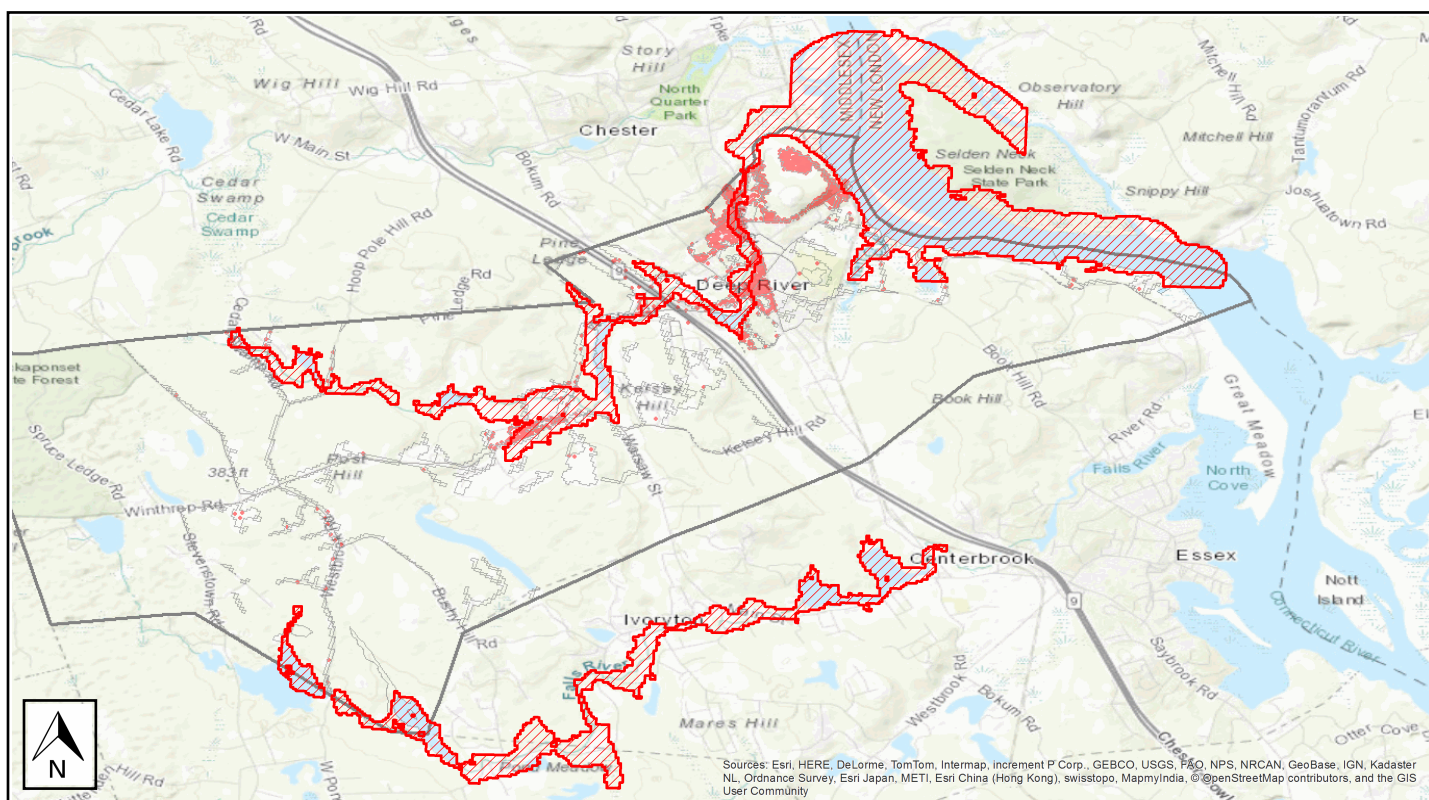


## Building Damage

### General Building Stock Damage

Hazus estimates that about 11 buildings will be at least moderately damaged. This is over 85% 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 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.

**Total Economic Loss (1 dot = \$300K) Overview Map**



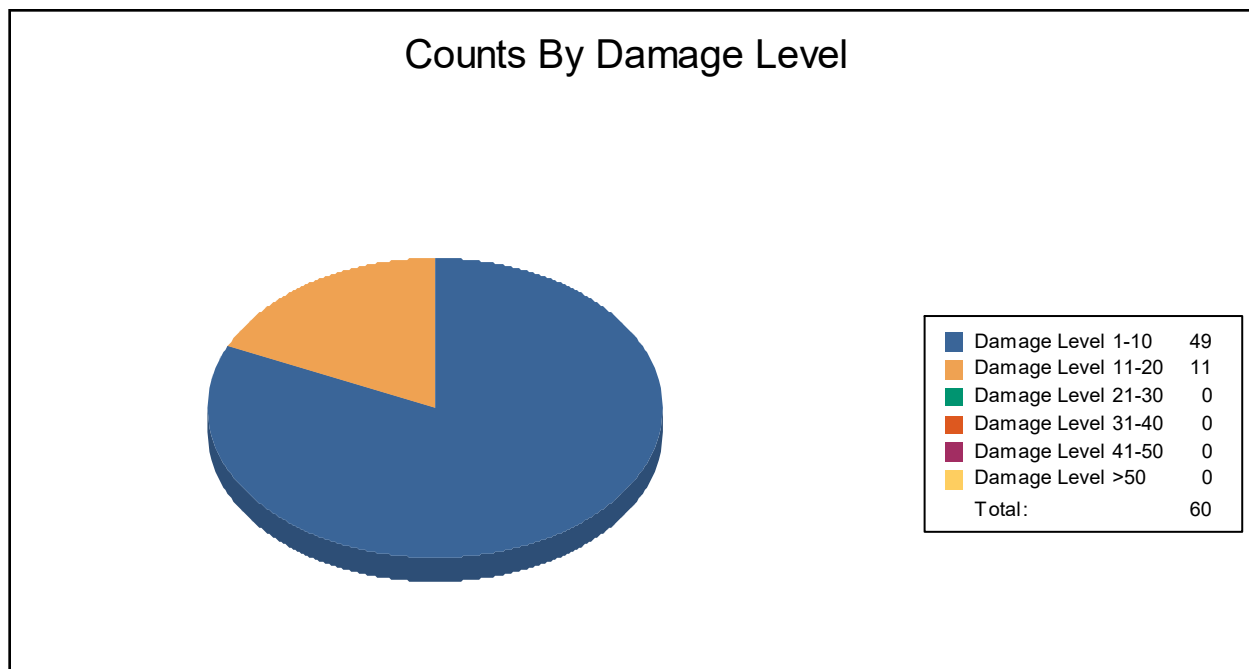
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**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	1	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	48	81	11	19	0	0	0	0	0	0	0	0
<b>Total</b>	<b>49</b>		<b>11</b>		<b>0</b>		<b>0</b>		<b>0</b>		<b>0</b>	



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**Table 4: Expected Building Damage by Building Type**

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	1	100	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	47	81	11	19	0	0	0	0	0	0	0	0



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## 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
Emergency Operation Centers	1	0	0	0
Fire Stations	2	1	0	1
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	4	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.



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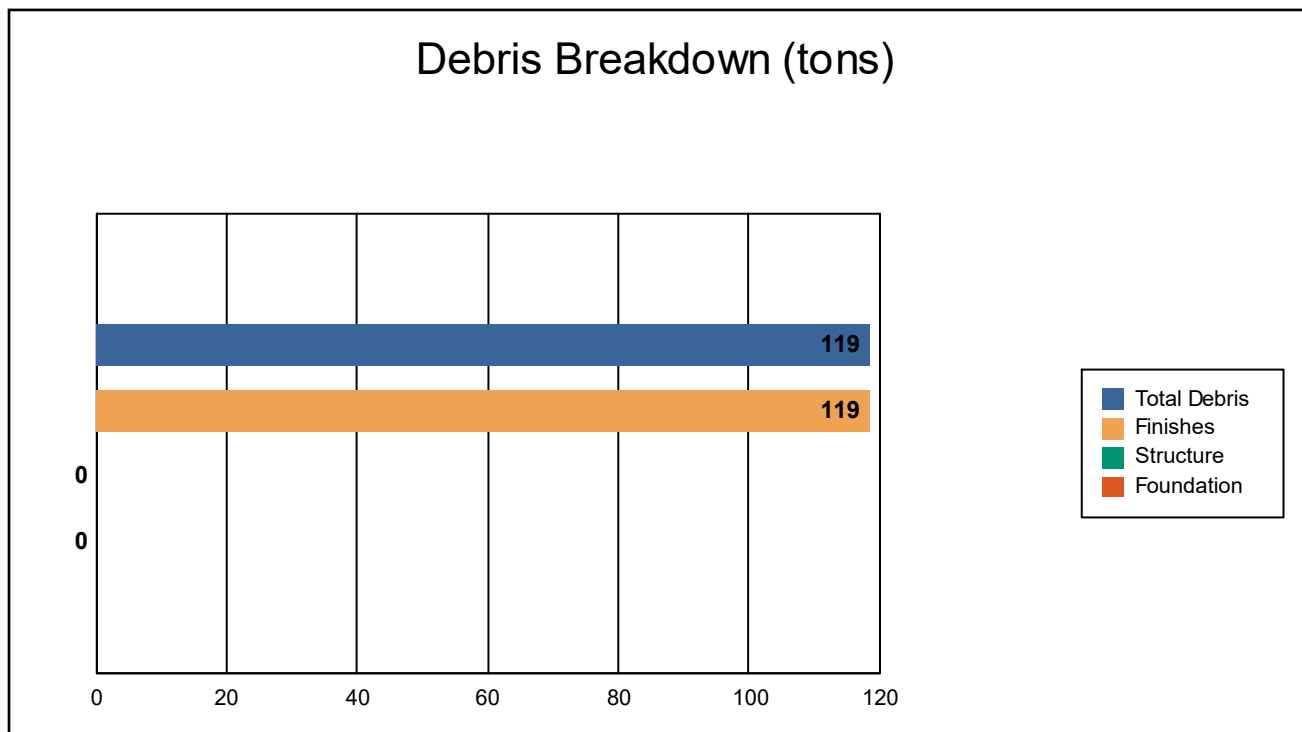
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## Induced Flood Damage

### 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.



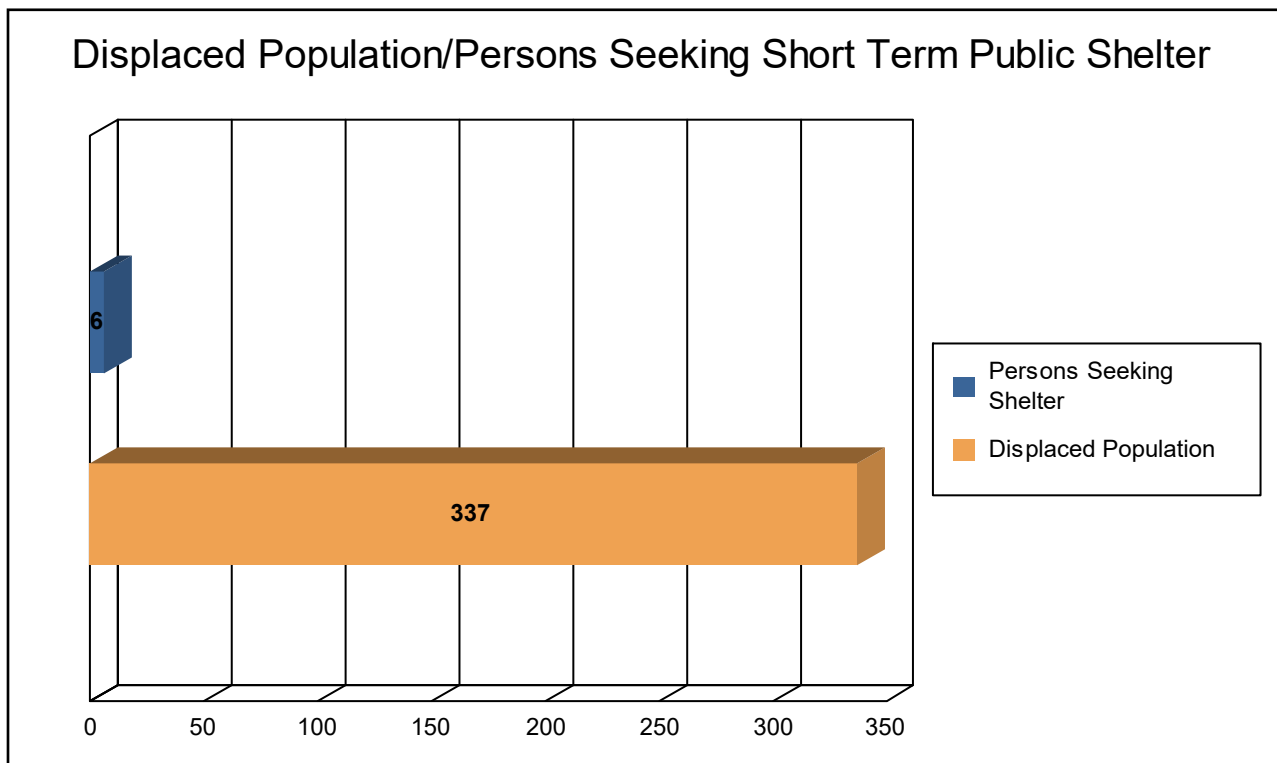
The model estimates that a total of 119 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 5 truckloads (@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 112 households (or 337 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 6 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the flood is 22.99 million dollars, which represents 3.88 % 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 7.24 million dollars. 69% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 27.27% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



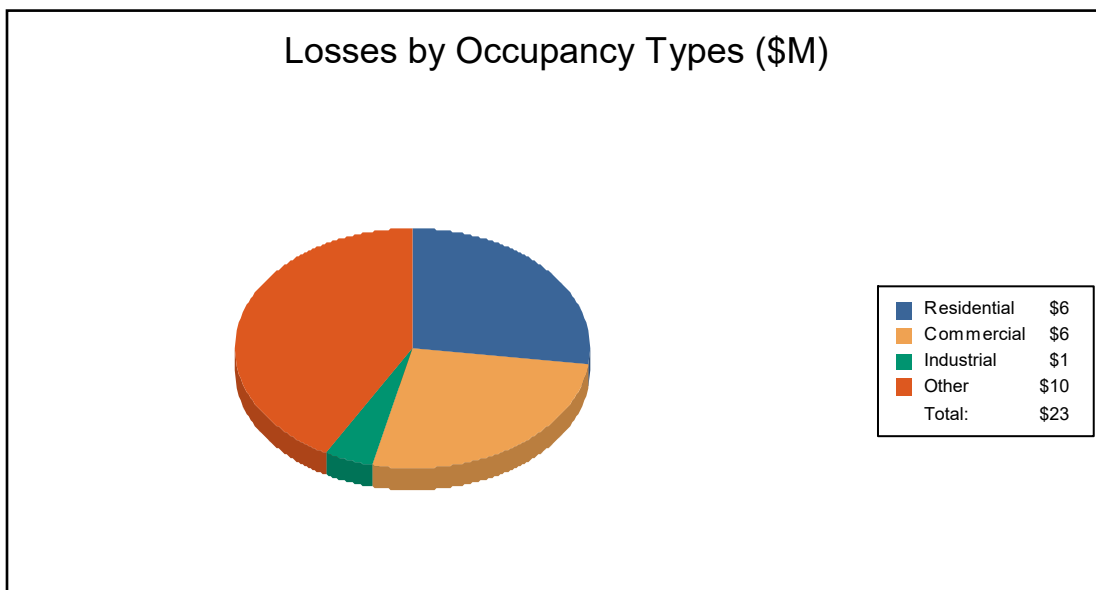
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**Table 6: Building-Related Economic Loss Estimates**  
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	2.42	0.33	0.25	0.22	3.21
	Content	1.19	1.01	0.60	1.17	3.97
	Inventory	0.00	0.00	0.04	0.00	0.05
	<b>Subtotal</b>	<b>3.61</b>	<b>1.34</b>	<b>0.90</b>	<b>1.40</b>	<b>7.24</b>
<b>Business Interruption</b>						
	Income	0.00	1.45	0.01	2.06	3.53
	Relocation	1.85	0.52	0.04	1.04	3.45
	Rental Income	0.79	0.39	0.01	0.05	1.23
	Wage	0.01	2.39	0.03	5.12	7.55
	<b>Subtotal</b>	<b>2.66</b>	<b>4.75</b>	<b>0.08</b>	<b>8.27</b>	<b>15.75</b>
<b>ALL</b>	<b>Total</b>	<b>6.27</b>	<b>6.08</b>	<b>0.98</b>	<b>9.66</b>	<b>22.99</b>



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## **Appendix A: County Listing for the Region**

Connecticut

- Middlesex



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## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Total Study Region</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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**Note:**

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## Building Inventory

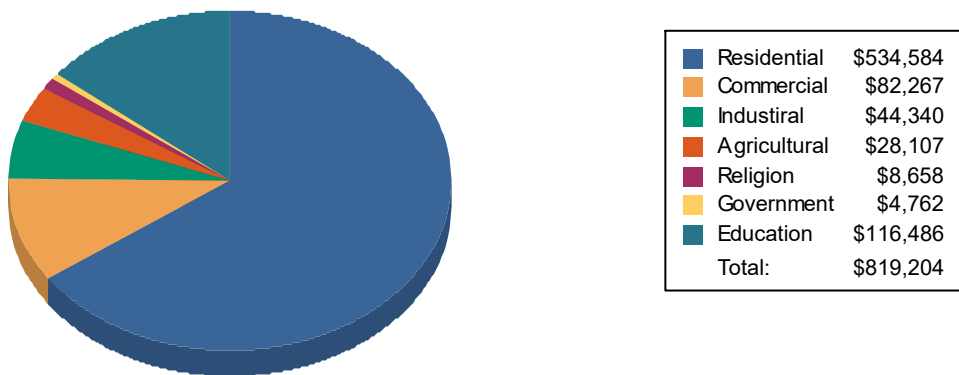
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**Table 1**  
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**Building Exposure by Occupancy Type for the Study Region**  
**(\$1000's)**



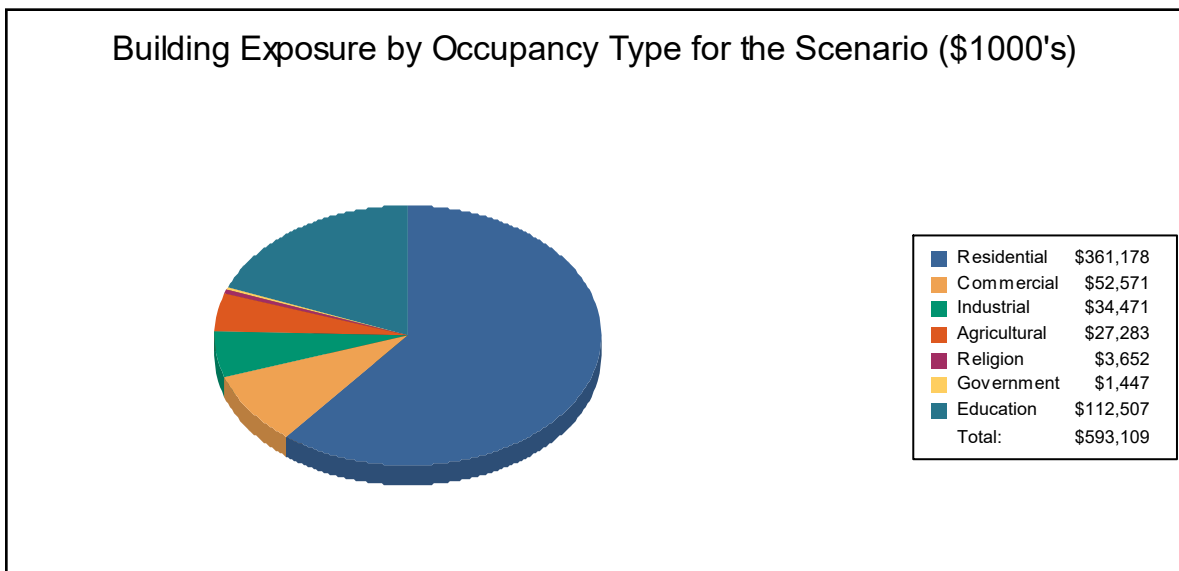
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
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Commercial	52,571	8.9%
Industrial	34,471	5.8%
Agricultural	27,283	4.6%
Religion	3,652	0.6%
Government	1,447	0.2%
Education	112,507	19.0%
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### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.  
There are 4 schools, 2 fire stations, 1 police station and 1 emergency operation center.



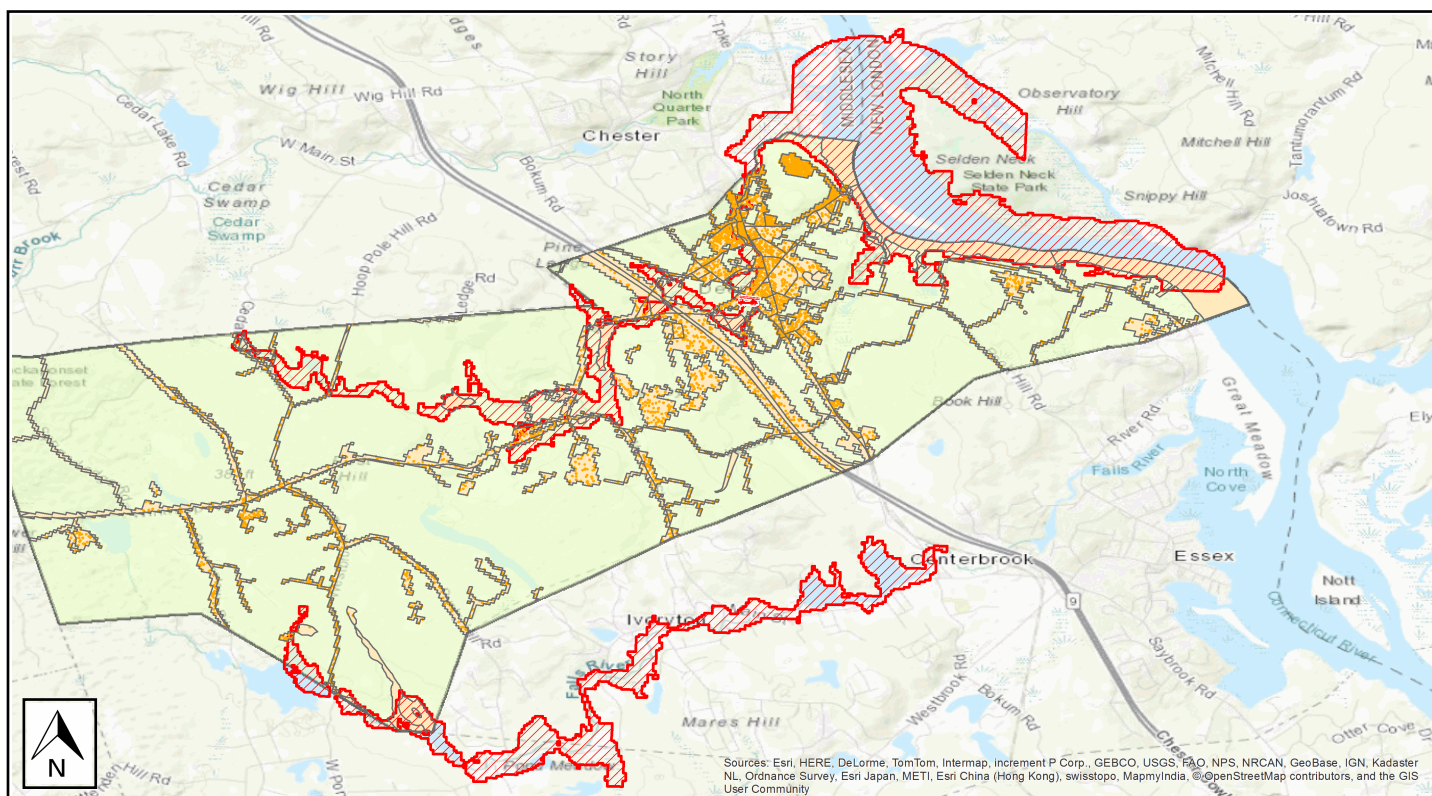
## Flood Scenario Parameters

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

<b>Study Region Name:</b>	DeepRiver
<b>Scenario Name:</b>	DeepRiverAll
<b>Return Period Analyzed:</b>	25
<b>Analysis Options Analyzed:</b>	No What-Ifs

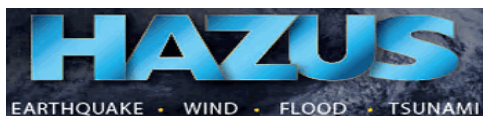
### Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



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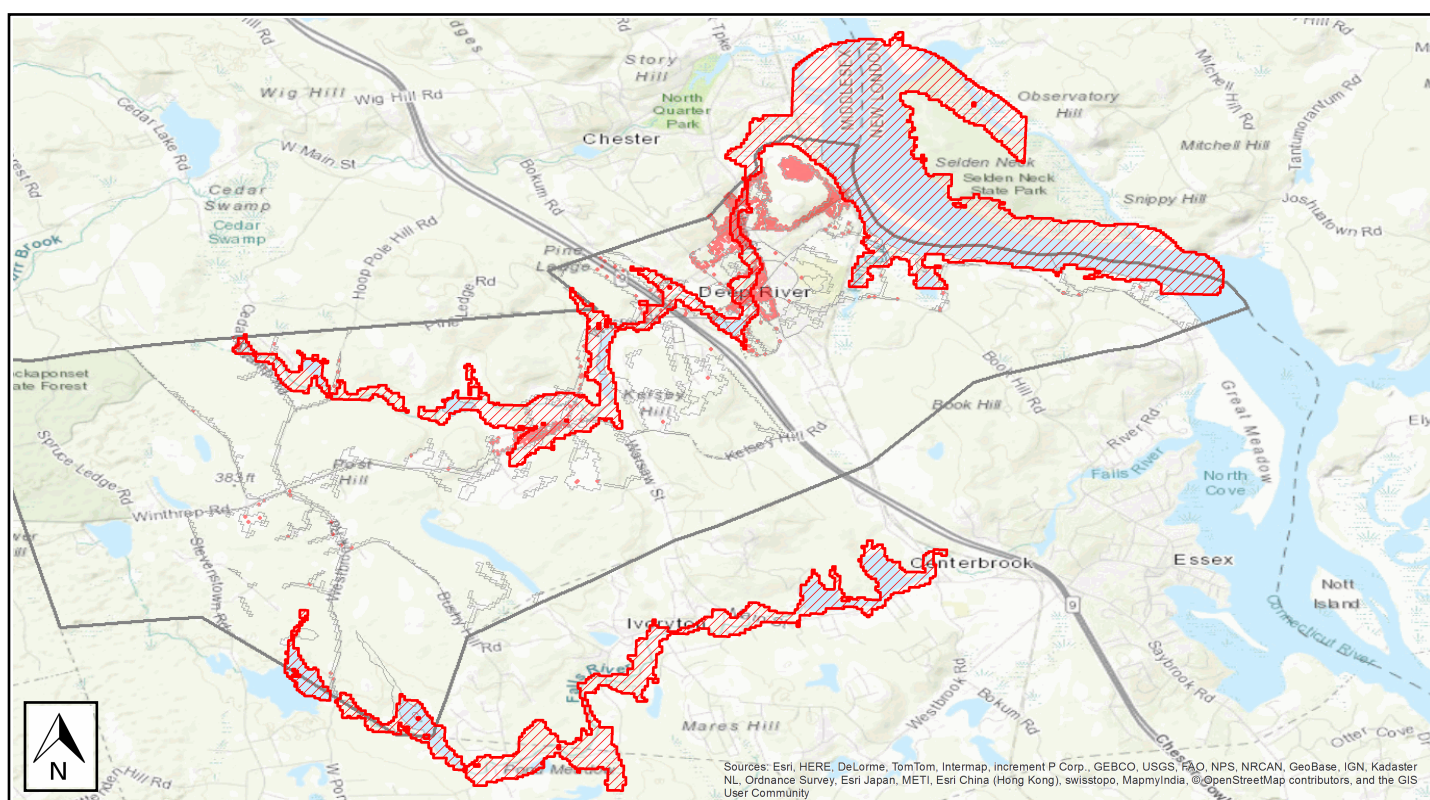


## Building Damage

### General Building Stock Damage

Hazus estimates that about 21 buildings will be at least moderately damaged. This is over 90% 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 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.

**Total Economic Loss (1 dot = \$300K) Overview Map**



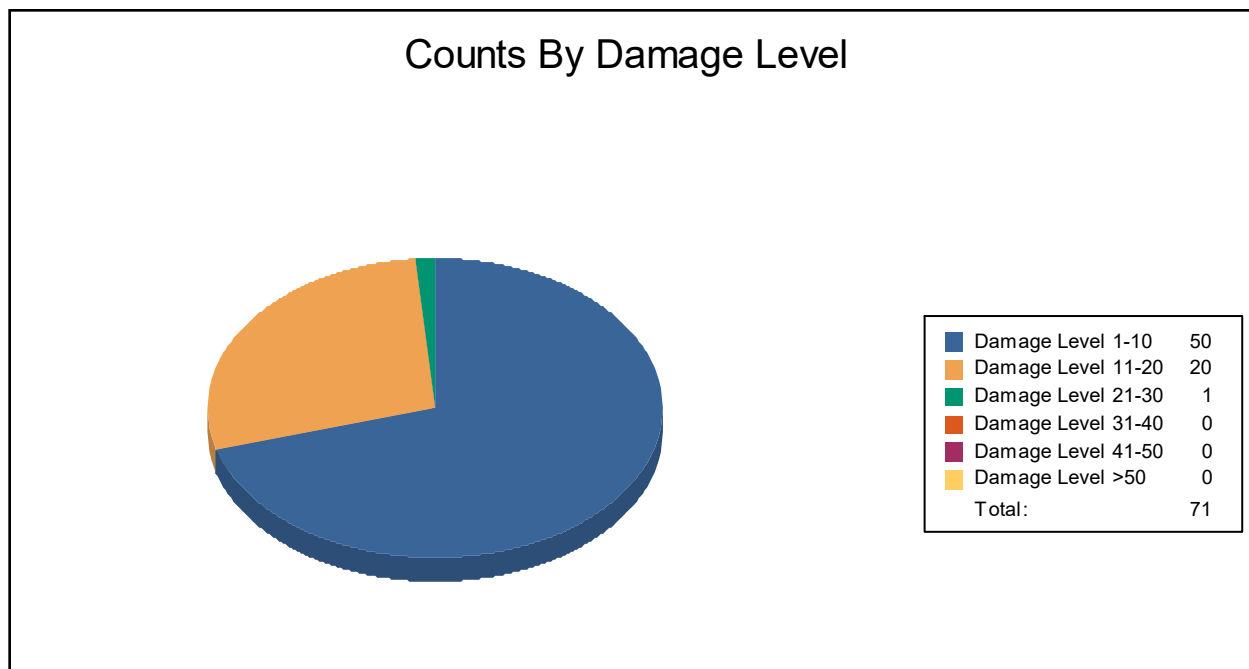
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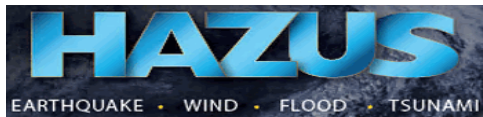
**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	48	70	20	29	1	1	0	0	0	0	0	0
<b>Total</b>	<b>50</b>		<b>20</b>		<b>1</b>		<b>0</b>		<b>0</b>		<b>0</b>	



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**Table 4: Expected Building Damage by Building Type**

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	1	100	0	0	0	0	0	0	0	0	0	0
Steel	1	100	0	0	0	0	0	0	0	0	0	0
Wood	48	70	20	29	1	1	0	0	0	0	0	0



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## 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
Emergency Operation Centers	1	0	0	0
Fire Stations	2	1	0	1
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	4	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.



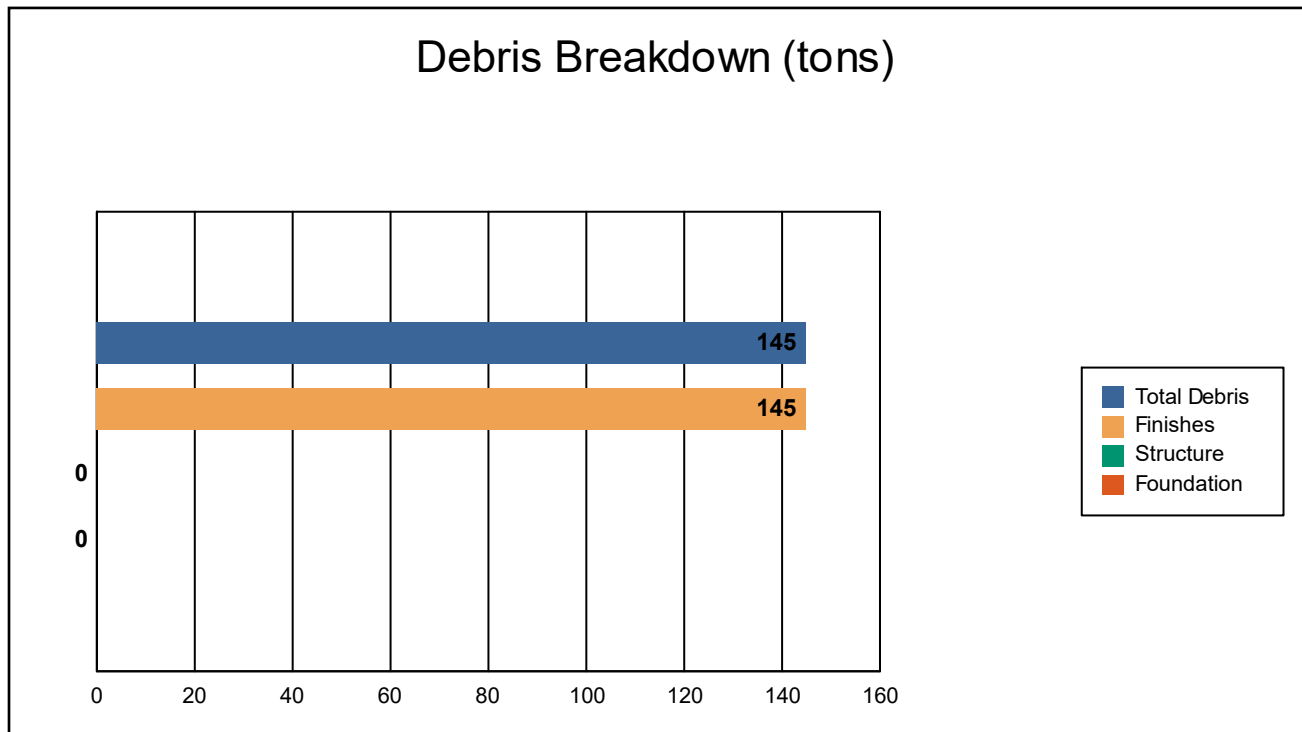
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## Induced Flood Damage

### 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.

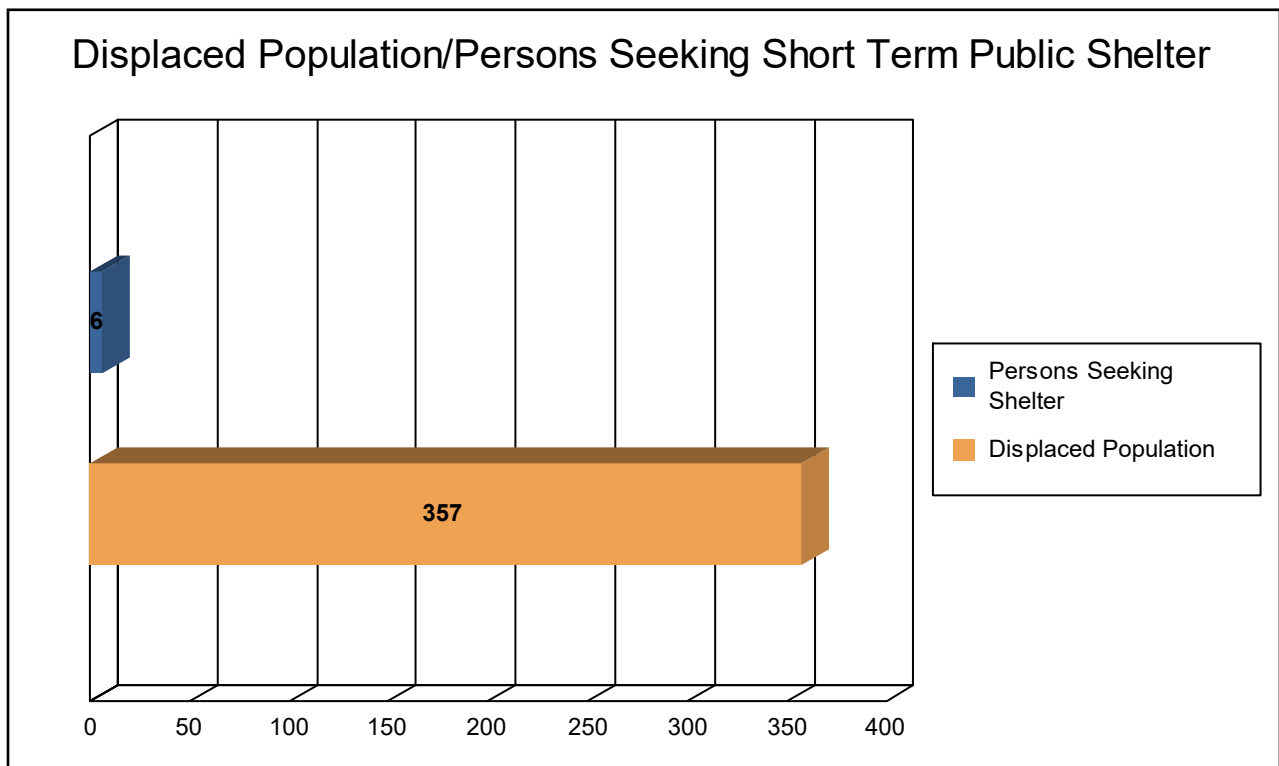


The model estimates that a total of 145 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 6 truckloads (@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 119 households (or 357 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 6 people (out of a total population of 4,629) will seek temporary shelter in public shelters.







## Economic Loss

The total economic loss estimated for the flood is 26.00 million dollars, which represents 4.38 % 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 9.50 million dollars. 63% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 27.93% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



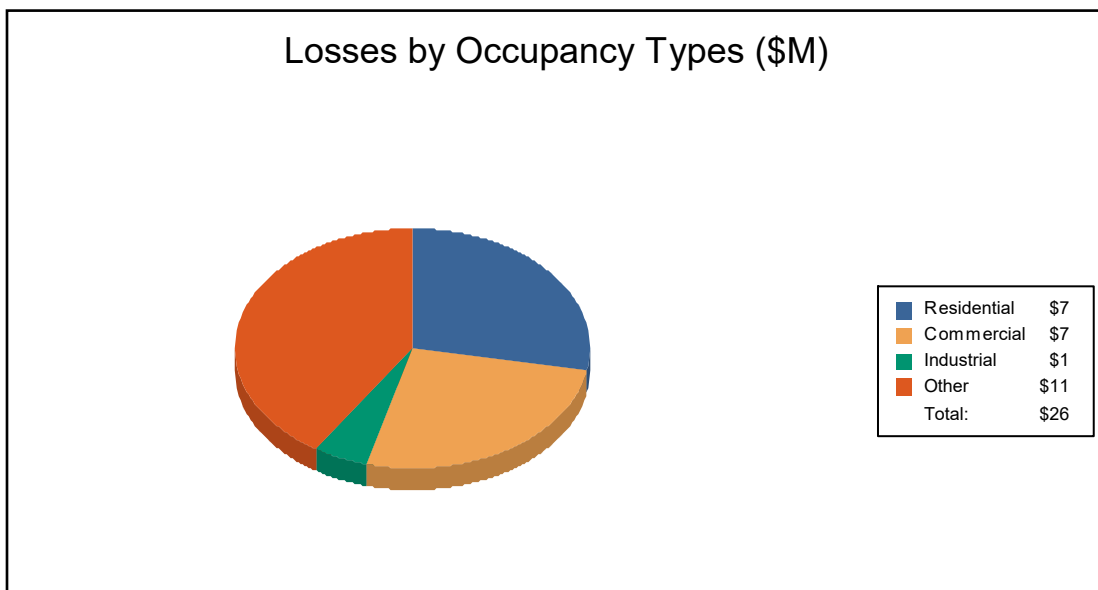
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**Table 6: Building-Related Economic Loss Estimates**  
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	3.00	0.46	0.33	0.32	4.10
	Content	1.46	1.37	0.80	1.71	5.33
	Inventory	0.00	0.01	0.06	0.00	0.07
	<b>Subtotal</b>	<b>4.45</b>	<b>1.83</b>	<b>1.19</b>	<b>2.03</b>	<b>9.50</b>
<b>Business Interruption</b>						
	Income	0.01	1.55	0.02	2.13	3.70
	Relocation	1.96	0.55	0.04	1.07	3.63
	Rental Income	0.83	0.41	0.01	0.05	1.29
	Wage	0.02	2.48	0.03	5.35	7.88
	<b>Subtotal</b>	<b>2.81</b>	<b>4.99</b>	<b>0.10</b>	<b>8.60</b>	<b>16.50</b>
<b>ALL</b>	<b>Total</b>	<b>7.26</b>	<b>6.82</b>	<b>1.29</b>	<b>10.63</b>	<b>26.00</b>



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## **Appendix A: County Listing for the Region**

Connecticut

- Middlesex



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## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Total Study Region</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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## Hazus: Flood Global Risk Report

**Region Name:** DeepRiver

**Flood Scenario:** DeepRiverAll

**Print Date:** Wednesday, January 8, 2020

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

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



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## General Description of the Region

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

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

- Connecticut

**Note:**

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

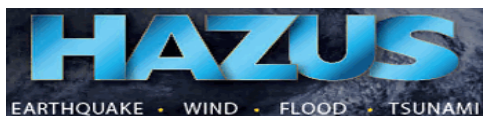
The geographical size of the region is approximately 14 square miles and contains 135 census blocks. The region contains over 2 thousand households and has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 1,997 buildings in the region with a total building replacement value (excluding contents) of 819 million dollars. Approximately 89.43% of the buildings (and 65.26% of the building value) are associated with residential housing.



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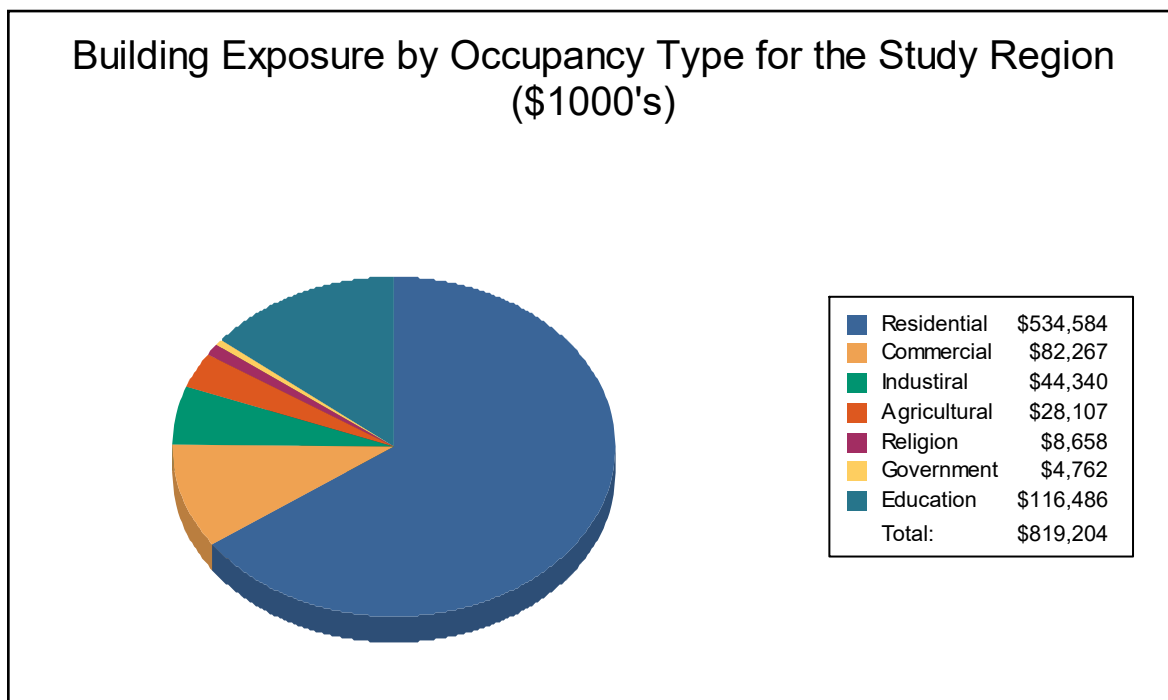
## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million 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	534,584	65.3%
Commercial	82,267	10.0%
Industrial	44,340	5.4%
Agricultural	28,107	3.4%
Religion	8,658	1.1%
Government	4,762	0.6%
Education	116,486	14.2%
<b>Total</b>	<b>819,204</b>	<b>100%</b>



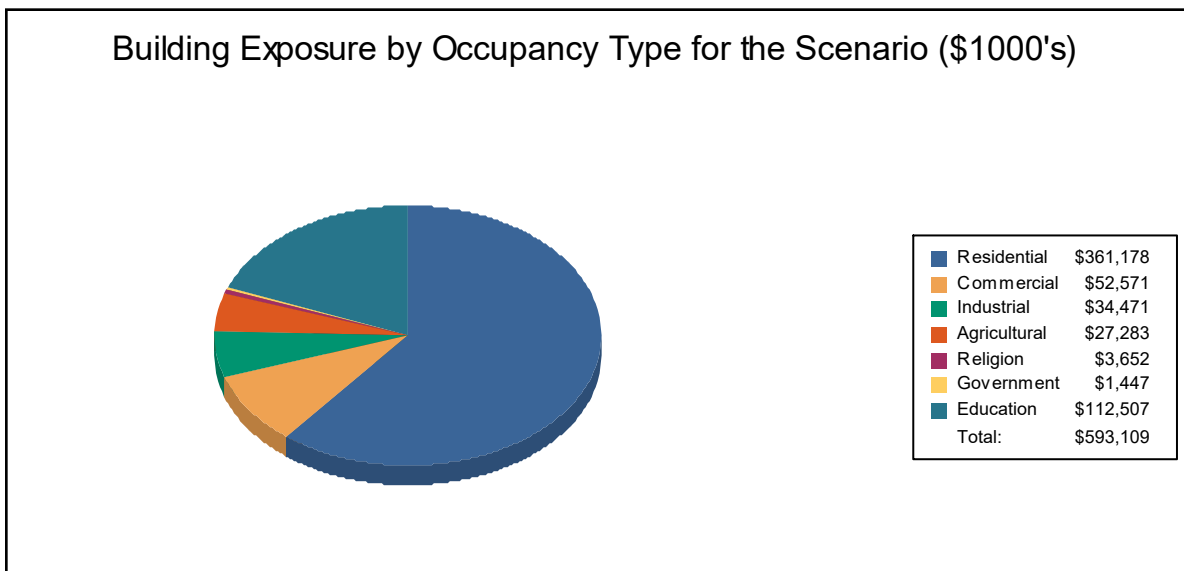
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	361,178	60.9%
Commercial	52,571	8.9%
Industrial	34,471	5.8%
Agricultural	27,283	4.6%
Religion	3,652	0.6%
Government	1,447	0.2%
Education	112,507	19.0%
<b>Total</b>	<b>593,109</b>	<b>100%</b>



### **Essential Facility Inventory**

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.  
There are 4 schools, 2 fire stations, 1 police station and 1 emergency operation center.



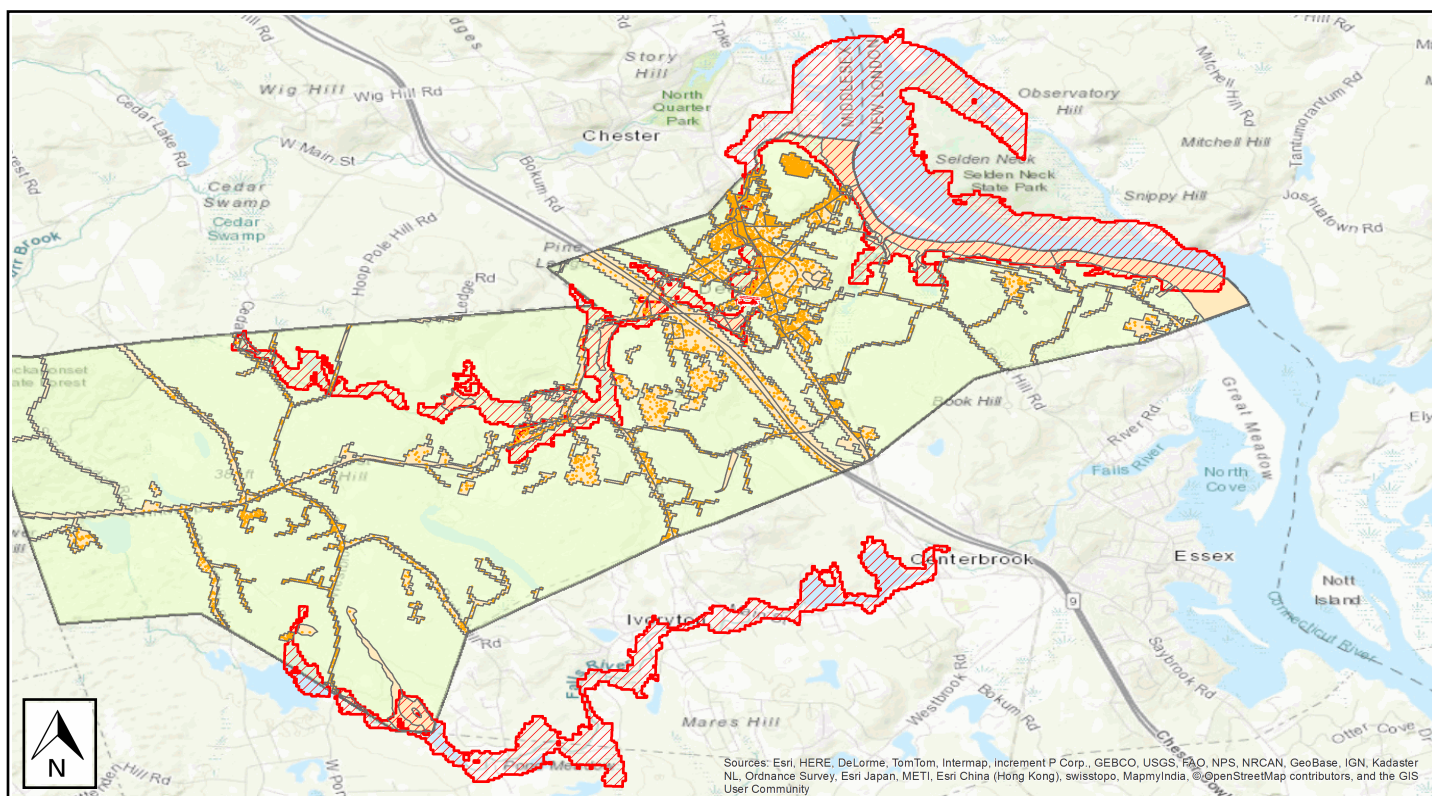
## Flood Scenario Parameters

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

<b>Study Region Name:</b>	DeepRiver
<b>Scenario Name:</b>	DeepRiverAll
<b>Return Period Analyzed:</b>	50
<b>Analysis Options Analyzed:</b>	No What-Ifs

### Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



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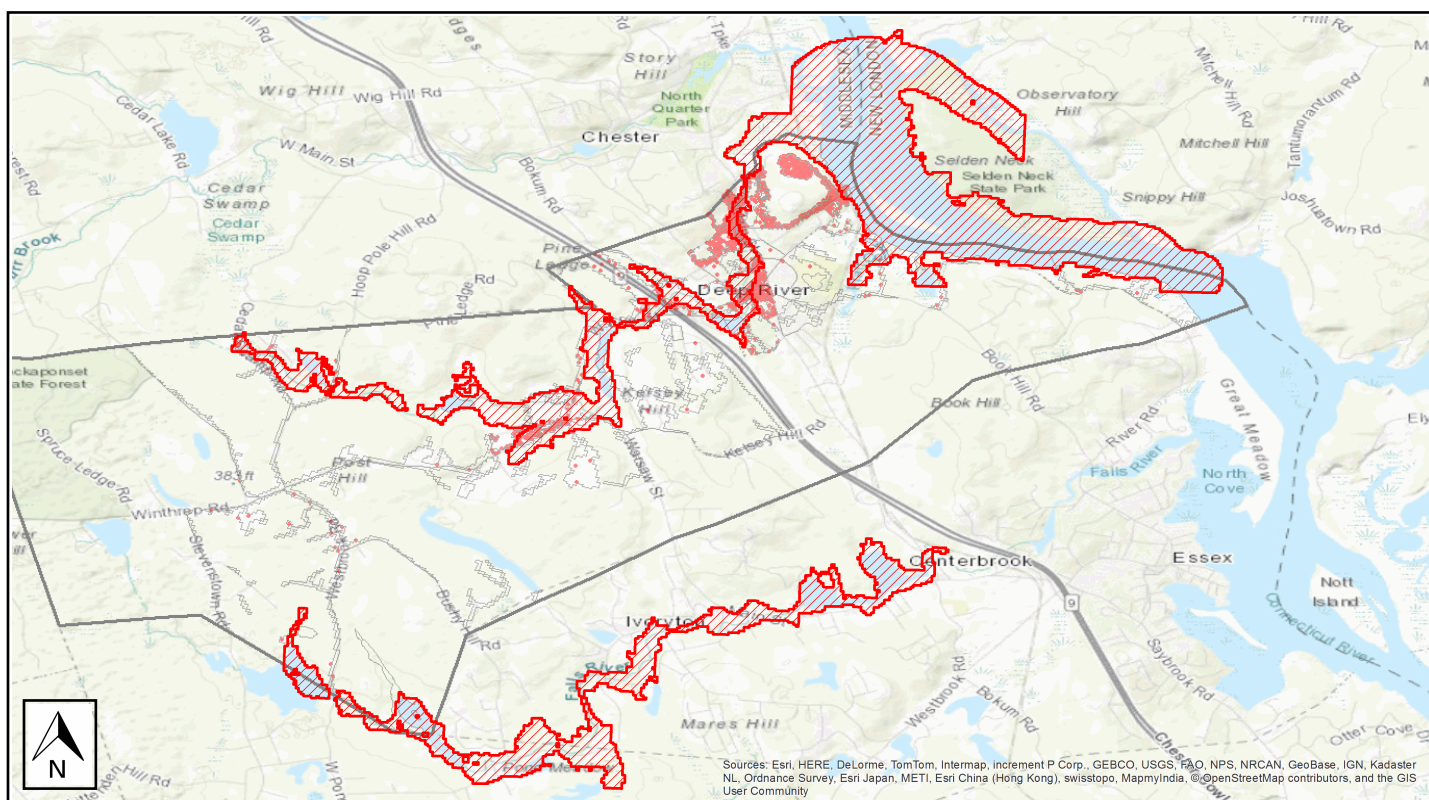


## Building Damage

### General Building Stock Damage

Hazus estimates that about 26 buildings will be at least moderately damaged. This is over 89% 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 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.

**Total Economic Loss (1 dot = \$300K) Overview Map**



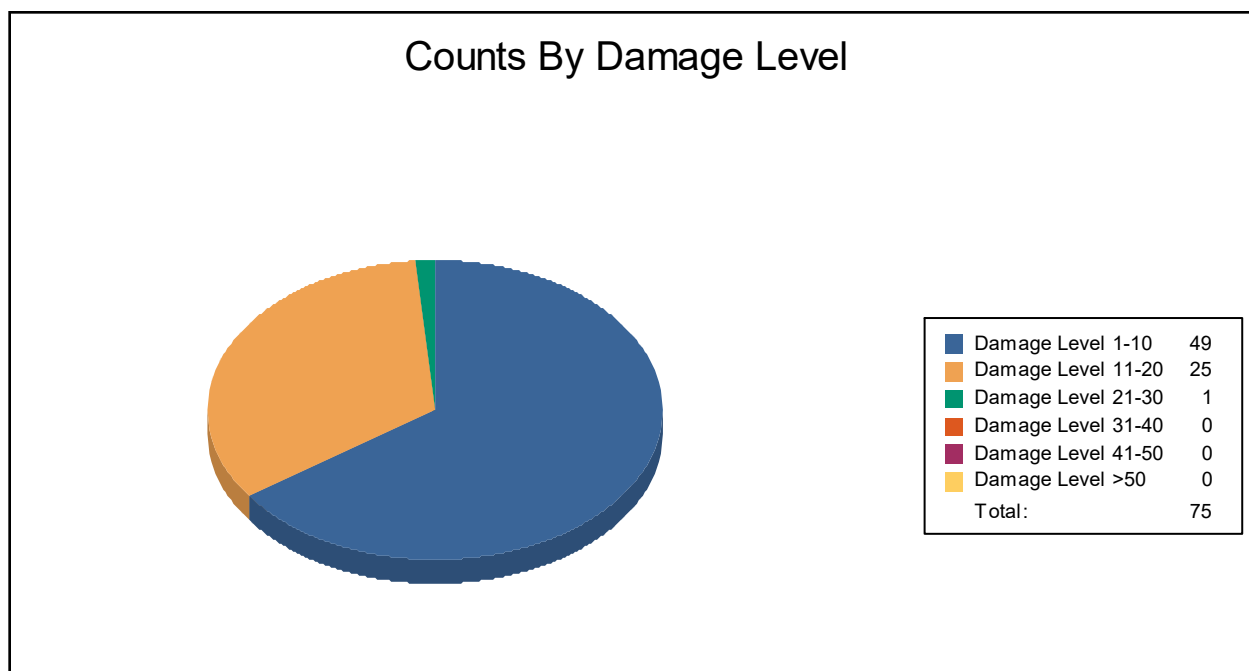
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**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	47	64	25	34	1	1	0	0	0	0	0	0
<b>Total</b>	<b>49</b>		<b>25</b>		<b>1</b>		<b>0</b>		<b>0</b>		<b>0</b>	



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**Table 4: Expected Building Damage by Building Type**

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	1	100	0	0	0	0	0	0	0	0	0	0
Steel	1	100	0	0	0	0	0	0	0	0	0	0
Wood	47	64	25	34	1	1	0	0	0	0	0	0



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## 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
Emergency Operation Centers	1	0	0	0
Fire Stations	2	1	0	1
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	4	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.



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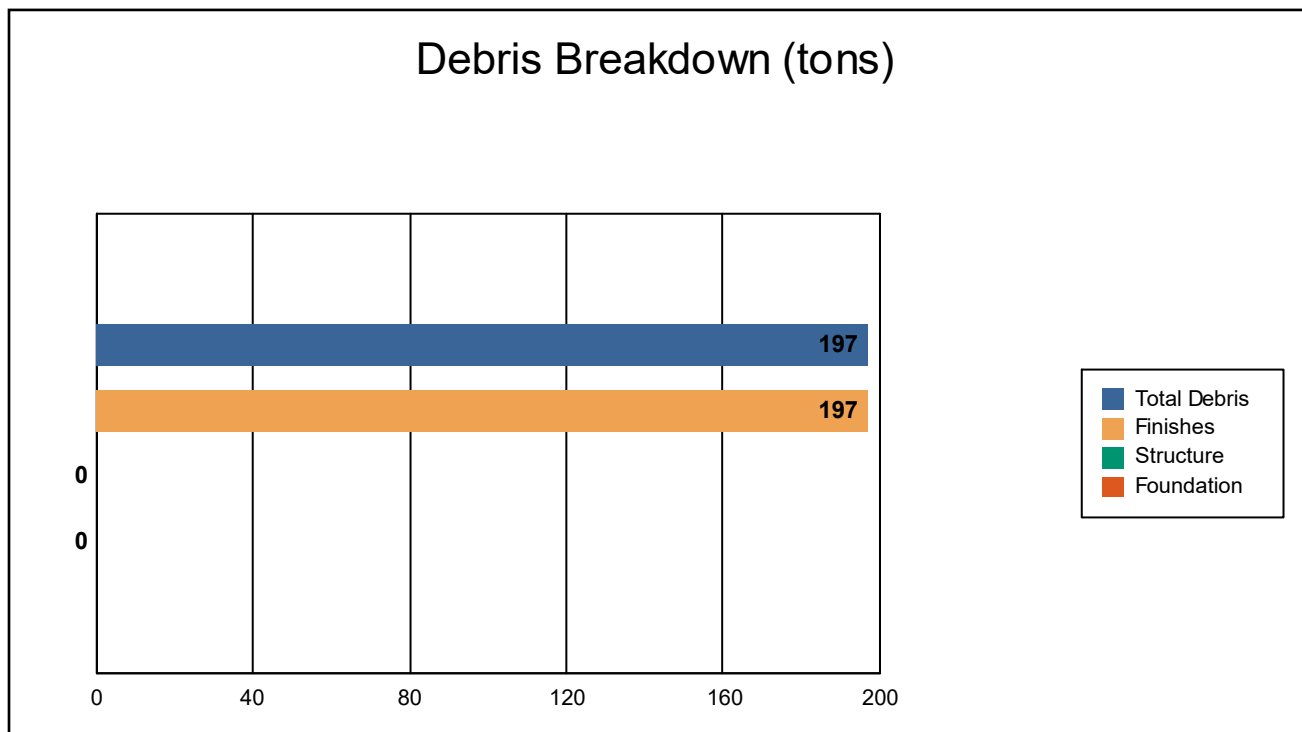
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## Induced Flood Damage

### 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 197 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 8 truckloads (@25 tons/truck) to remove the debris generated by the flood.



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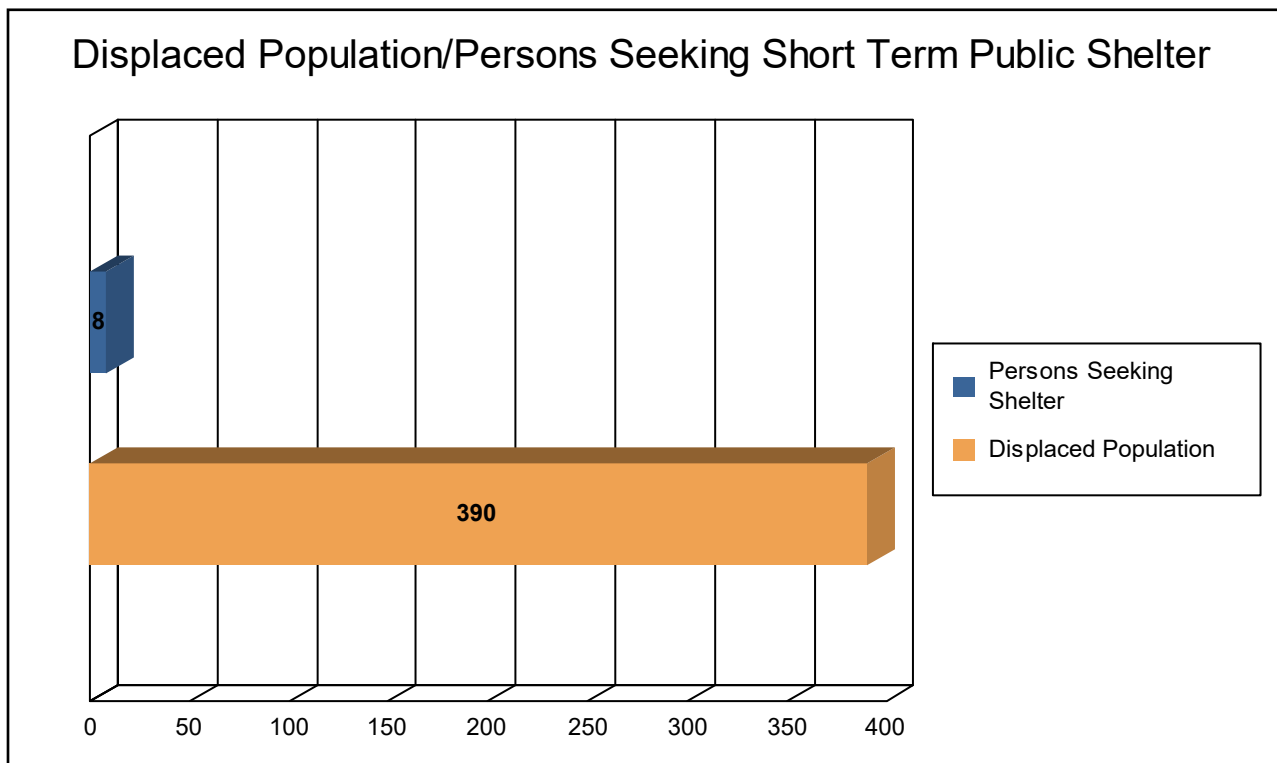
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## Social Impact

### 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 (or 390 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 8 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the flood is 29.77 million dollars, which represents 5.02 % 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 11.75 million dollars. 61% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 28.02% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



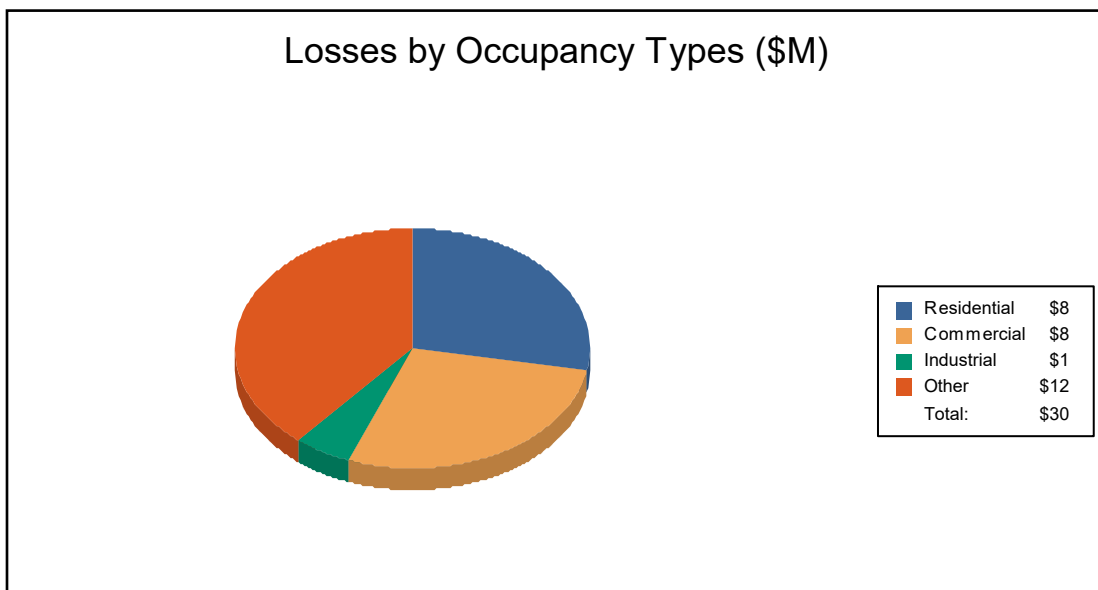
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**Table 6: Building-Related Economic Loss Estimates**  
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	3.56	0.60	0.38	0.41	4.95
	Content	1.68	1.89	0.94	2.23	6.73
	Inventory	0.00	0.01	0.07	0.01	0.08
	<b>Subtotal</b>	<b>5.23</b>	<b>2.49</b>	<b>1.39</b>	<b>2.64</b>	<b>11.75</b>
<b>Business Interruption</b>						
	Income	0.01	1.79	0.02	2.21	4.03
	Relocation	2.17	0.64	0.05	1.12	3.97
	Rental Income	0.91	0.48	0.01	0.06	1.45
	Wage	0.02	2.92	0.04	5.59	8.57
	<b>Subtotal</b>	<b>3.11</b>	<b>5.83</b>	<b>0.11</b>	<b>8.98</b>	<b>18.02</b>
<b>ALL</b>	<b>Total</b>	<b>8.34</b>	<b>8.32</b>	<b>1.49</b>	<b>11.62</b>	<b>29.77</b>



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## **Appendix A: County Listing for the Region**

Connecticut

- Middlesex



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## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Total Study Region</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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## Hazus: Flood Global Risk Report

**Region Name:** DeepRiver

**Flood Scenario:** DeepRiverAll

**Print Date:** Wednesday, January 8, 2020

**Disclaimer:**

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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 approximately 14 square miles and contains 135 census blocks. The region contains over 2 thousand households and has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 1,997 buildings in the region with a total building replacement value (excluding contents) of 819 million dollars. Approximately 89.43% of the buildings (and 65.26% of the building value) are associated with residential housing.



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## Building Inventory

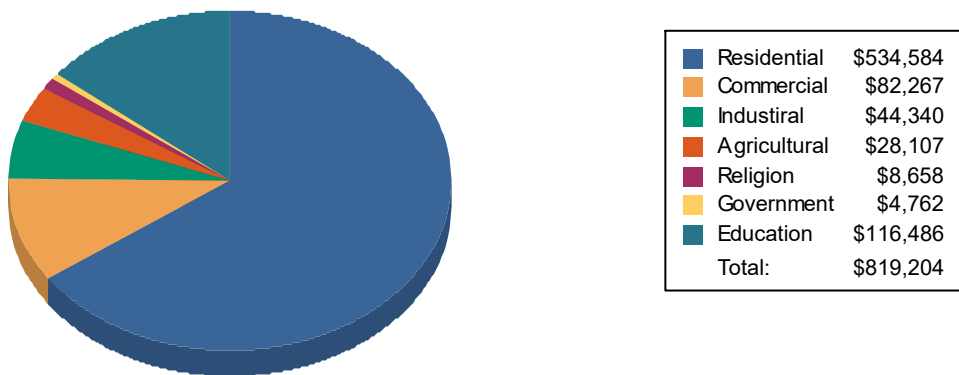
### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million 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	534,584	65.3%
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Industrial	44,340	5.4%
Agricultural	28,107	3.4%
Religion	8,658	1.1%
Government	4,762	0.6%
Education	116,486	14.2%
<b>Total</b>	<b>819,204</b>	<b>100%</b>

**Building Exposure by Occupancy Type for the Study Region**  
**(\$1000's)**



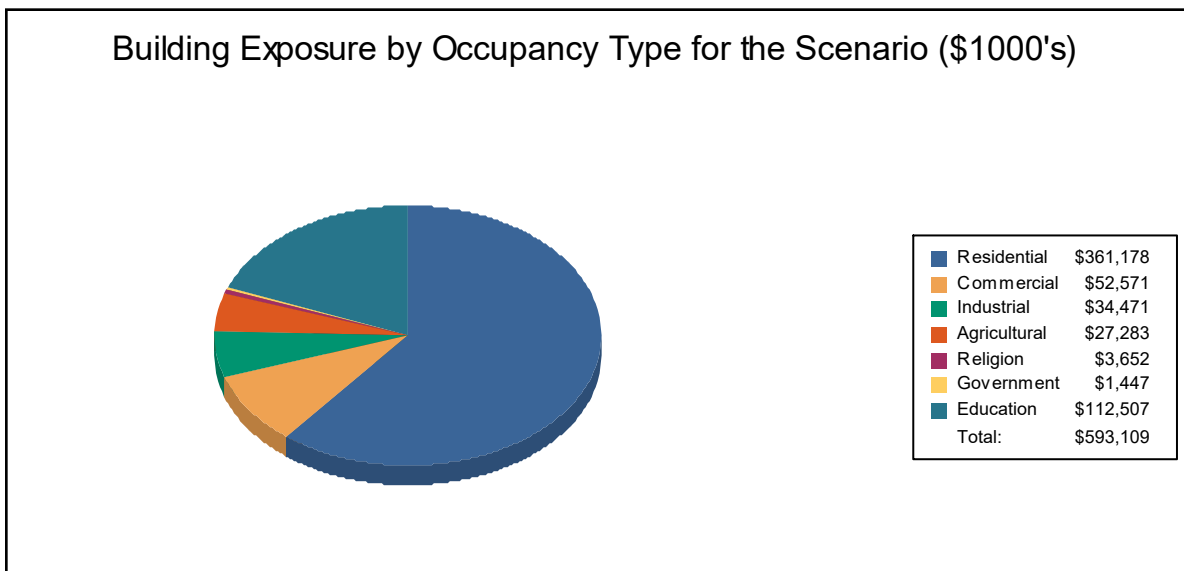
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	361,178	60.9%
Commercial	52,571	8.9%
Industrial	34,471	5.8%
Agricultural	27,283	4.6%
Religion	3,652	0.6%
Government	1,447	0.2%
Education	112,507	19.0%
<b>Total</b>	<b>593,109</b>	<b>100%</b>



### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.  
There are 4 schools, 2 fire stations, 1 police station and 1 emergency operation center.



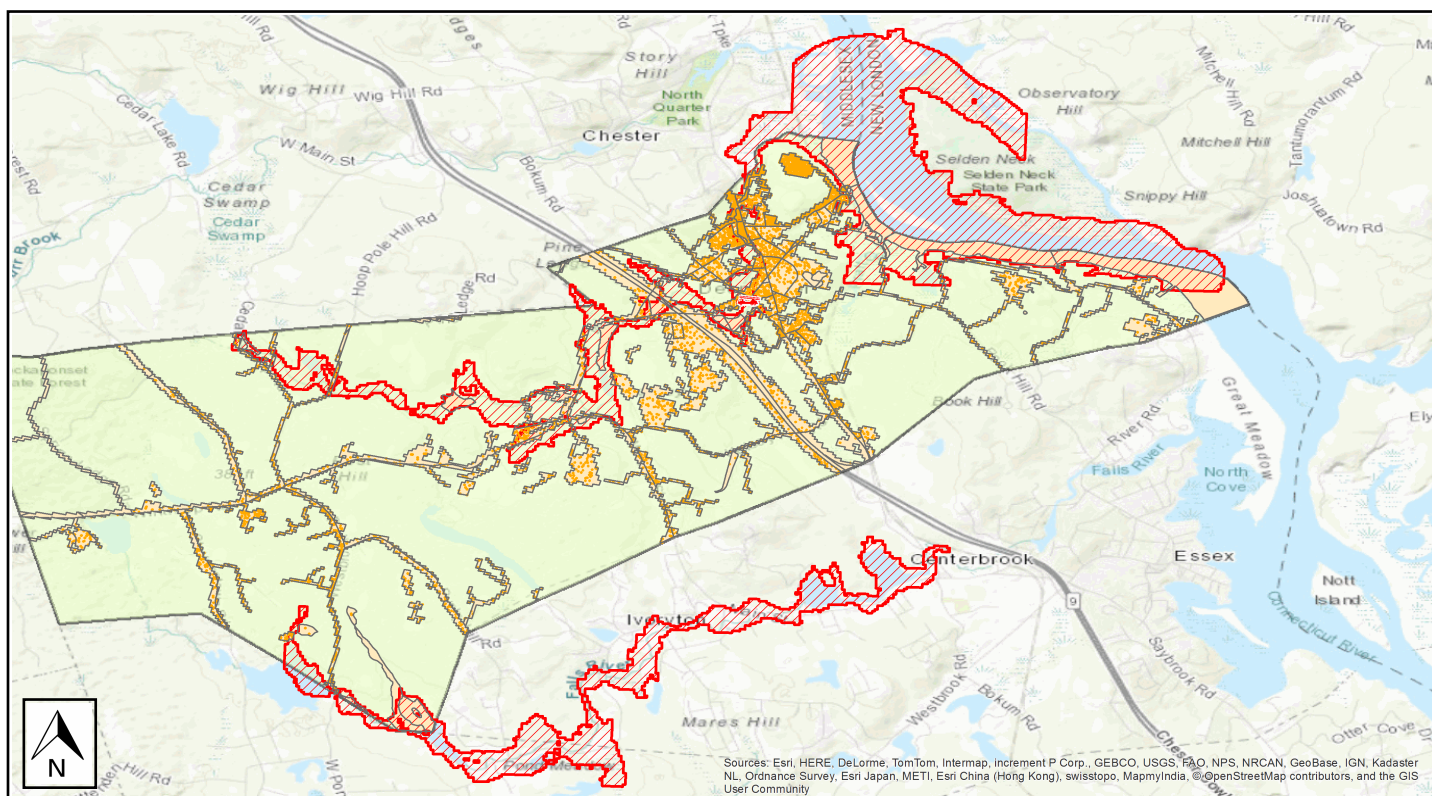
## Flood Scenario Parameters

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

<b>Study Region Name:</b>	DeepRiver
<b>Scenario Name:</b>	DeepRiverAll
<b>Return Period Analyzed:</b>	100
<b>Analysis Options Analyzed:</b>	No What-Ifs

## Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



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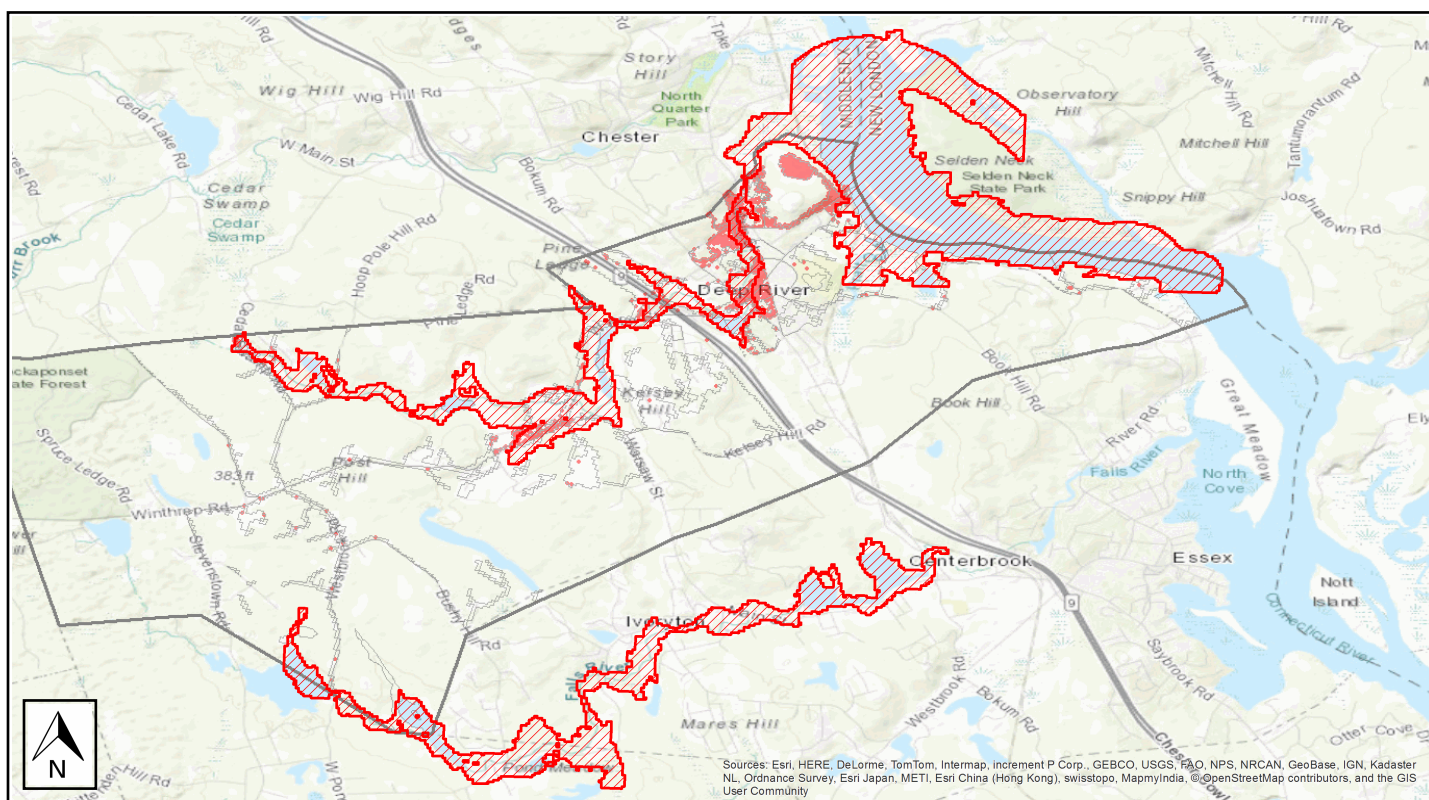


## Building Damage

### General Building Stock Damage

Hazus estimates that about 35 buildings will be at least moderately damaged. This is over 91% 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 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.

**Total Economic Loss (1 dot = \$300K) Overview Map**



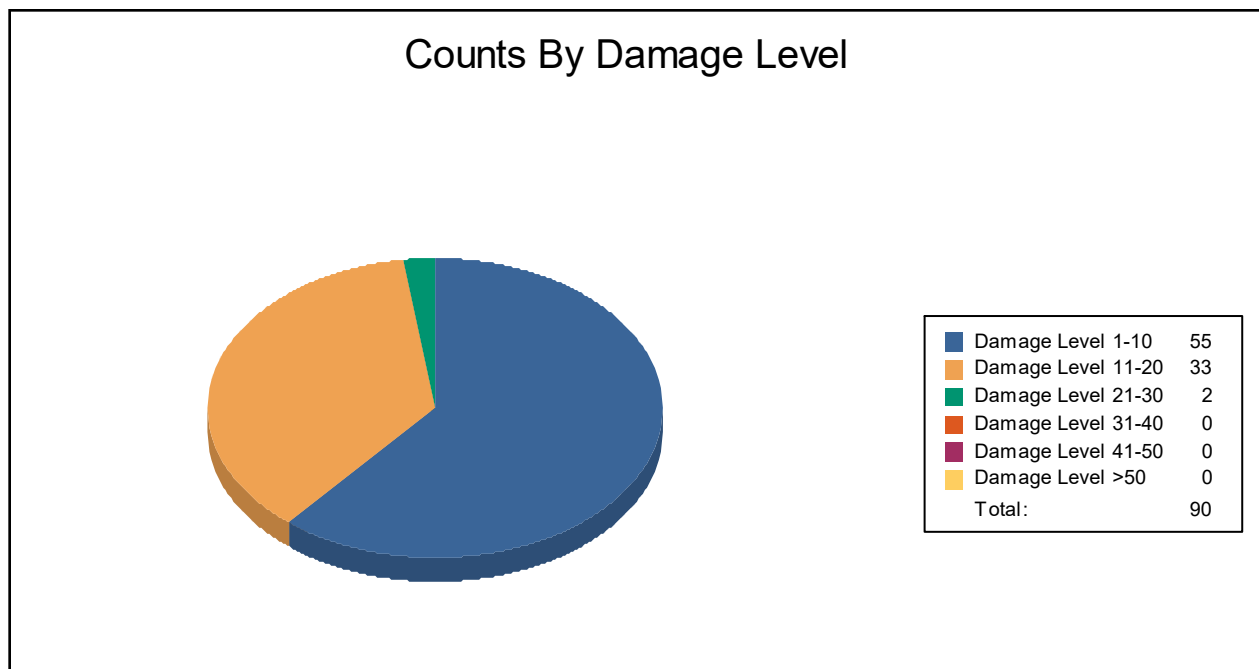
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**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	53	60	33	38	2	2	0	0	0	0	0	0
<b>Total</b>	<b>55</b>		<b>33</b>		<b>2</b>		<b>0</b>		<b>0</b>		<b>0</b>	



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**Table 4: Expected Building Damage by Building Type**

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	1	50	1	50	0	0	0	0	0	0	0	0
Steel	1	100	0	0	0	0	0	0	0	0	0	0
Wood	53	61	32	37	2	2	0	0	0	0	0	0



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## 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
Emergency Operation Centers	1	0	0	0
Fire Stations	2	1	0	1
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	4	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.



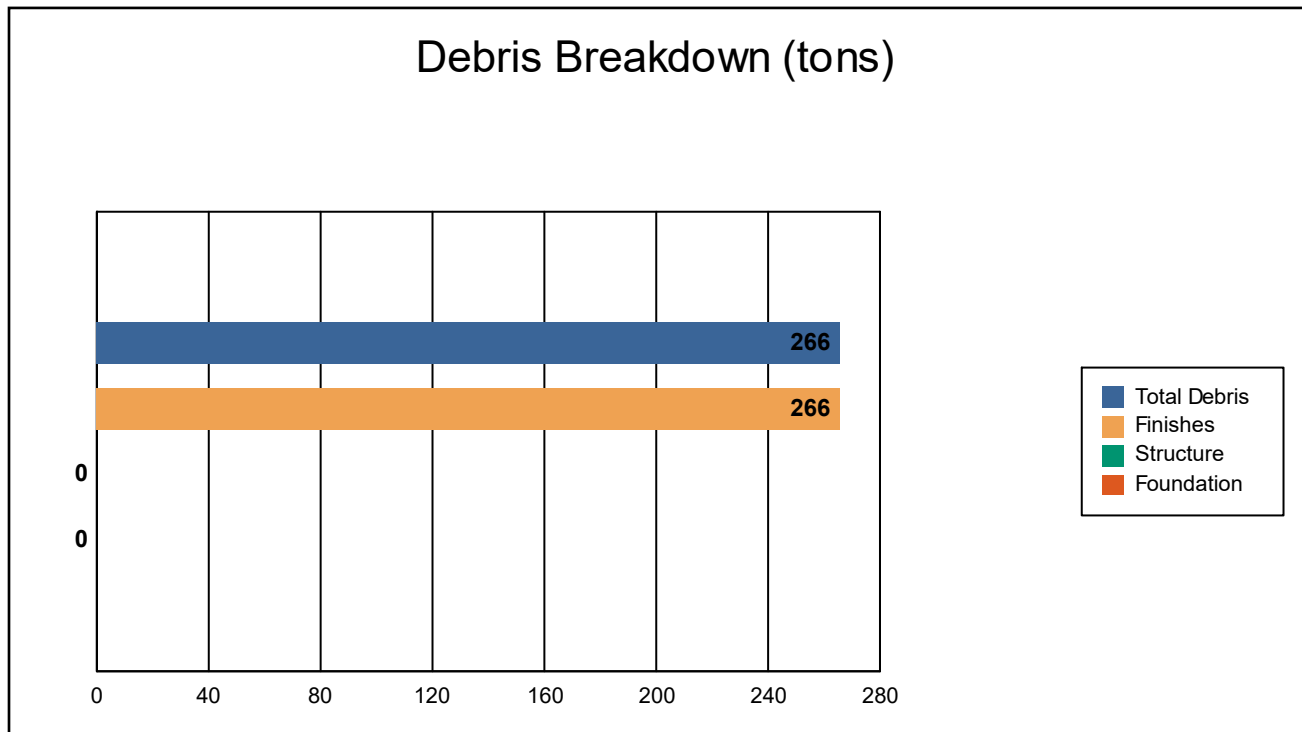
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## Induced Flood Damage

### 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.



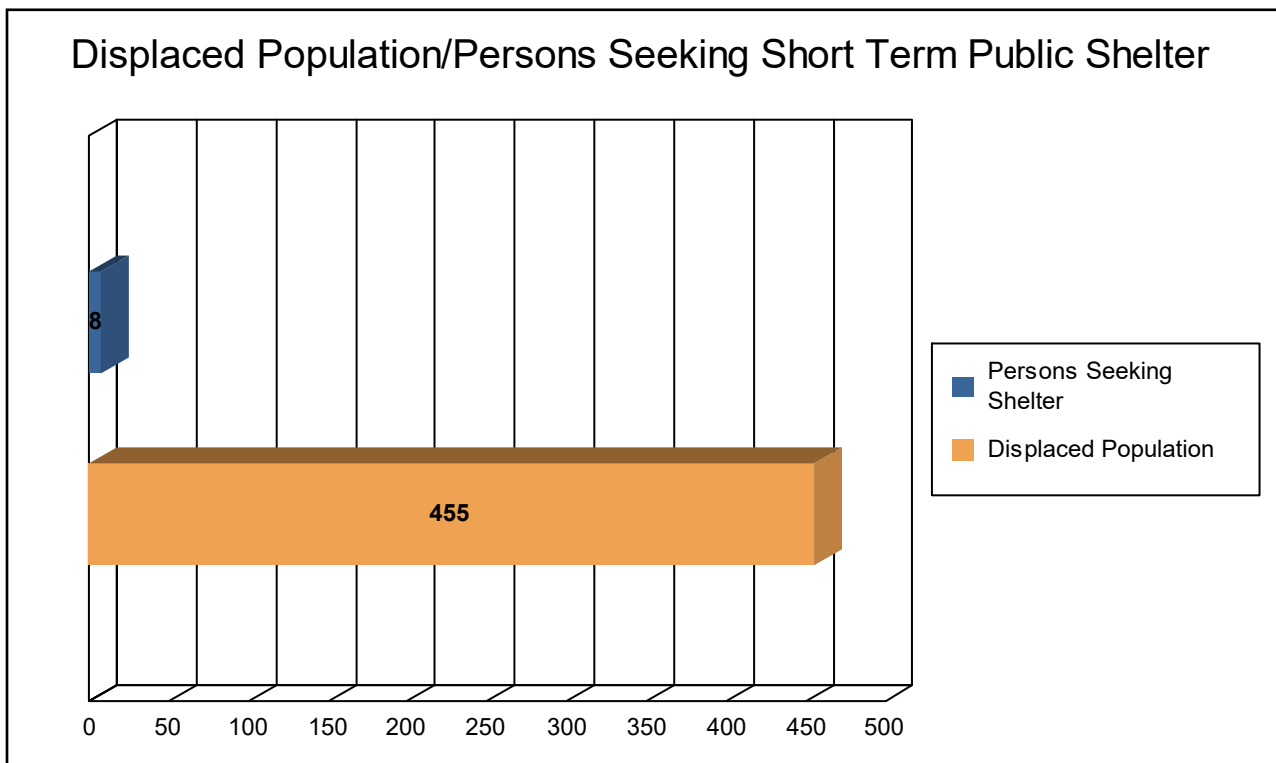
The model estimates that a total of 266 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 11 truckloads (@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 152 households (or 455 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 8 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the flood is 35.03 million dollars, which represents 5.91 % 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 15.05 million dollars. 57% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 29.07% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



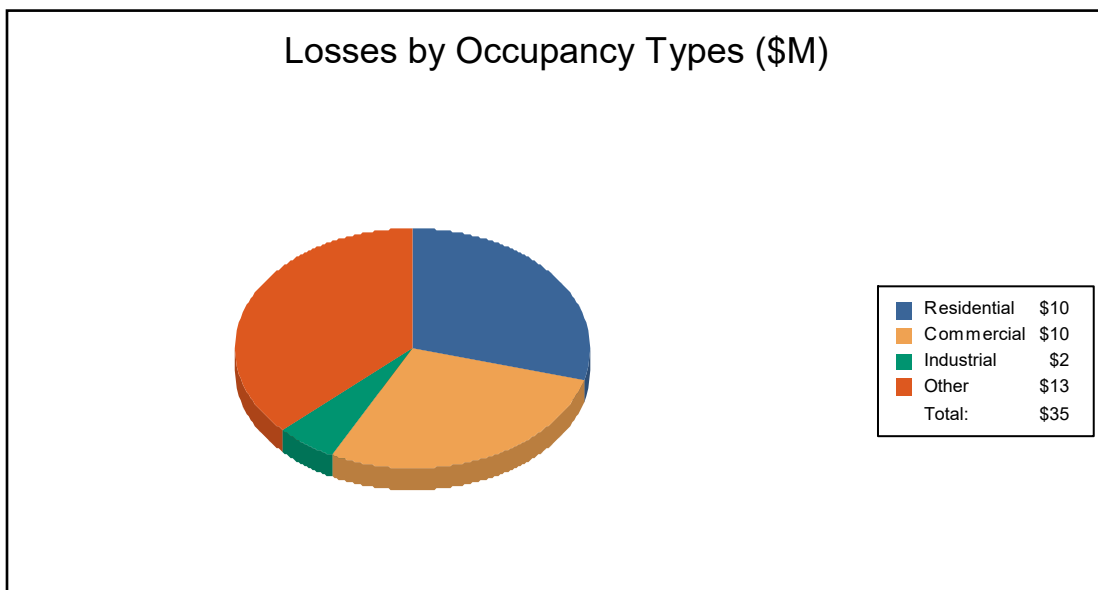
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**Table 6: Building-Related Economic Loss Estimates**  
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Building Loss</u>						
	Building	4.47	0.79	0.48	0.52	6.25
	Content	2.08	2.51	1.19	2.90	8.68
	Inventory	0.00	0.01	0.10	0.01	0.12
	<b>Subtotal</b>	<b>6.55</b>	<b>3.30</b>	<b>1.77</b>	<b>3.43</b>	<b>15.05</b>
<u>Business Interruption</u>						
	Income	0.01	2.12	0.03	2.35	4.50
	Relocation	2.53	0.74	0.06	1.18	4.50
	Rental Income	1.07	0.55	0.01	0.06	1.69
	Wage	0.03	3.26	0.05	5.96	9.30
	<b>Subtotal</b>	<b>3.63</b>	<b>6.67</b>	<b>0.14</b>	<b>9.55</b>	<b>19.99</b>
<b>ALL</b>	<b>Total</b>	<b>10.18</b>	<b>9.97</b>	<b>1.91</b>	<b>12.97</b>	<b>35.03</b>



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## **Appendix A: County Listing for the Region**

Connecticut

- Middlesex



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## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Total Study Region</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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## Hazus: Flood Global Risk Report

**Region Name:** DeepRiver

**Flood Scenario:** DeepRiverAll

**Print Date:** Wednesday, January 8, 2020

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

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



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## General Description of the Region

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

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

- Connecticut

**Note:**

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

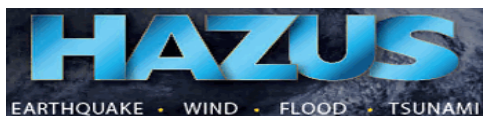
The geographical size of the region is approximately 14 square miles and contains 135 census blocks. The region contains over 2 thousand households and has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 1,997 buildings in the region with a total building replacement value (excluding contents) of 819 million dollars. Approximately 89.43% of the buildings (and 65.26% of the building value) are associated with residential housing.



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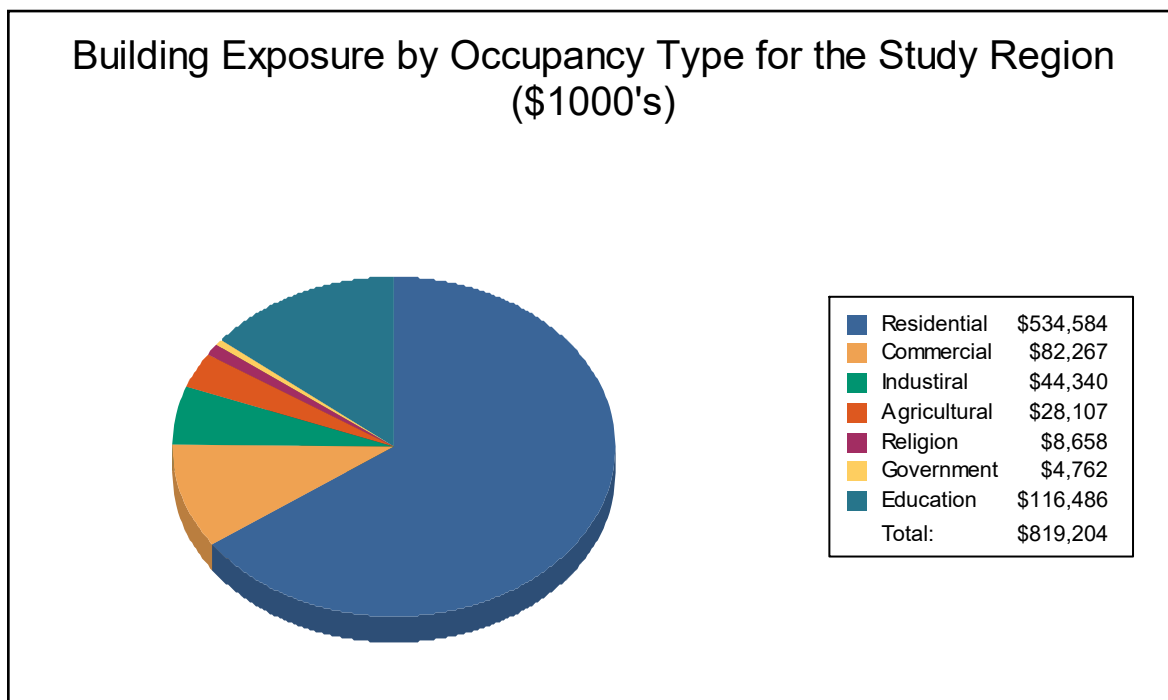
## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million 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	534,584	65.3%
Commercial	82,267	10.0%
Industrial	44,340	5.4%
Agricultural	28,107	3.4%
Religion	8,658	1.1%
Government	4,762	0.6%
Education	116,486	14.2%
<b>Total</b>	<b>819,204</b>	<b>100%</b>



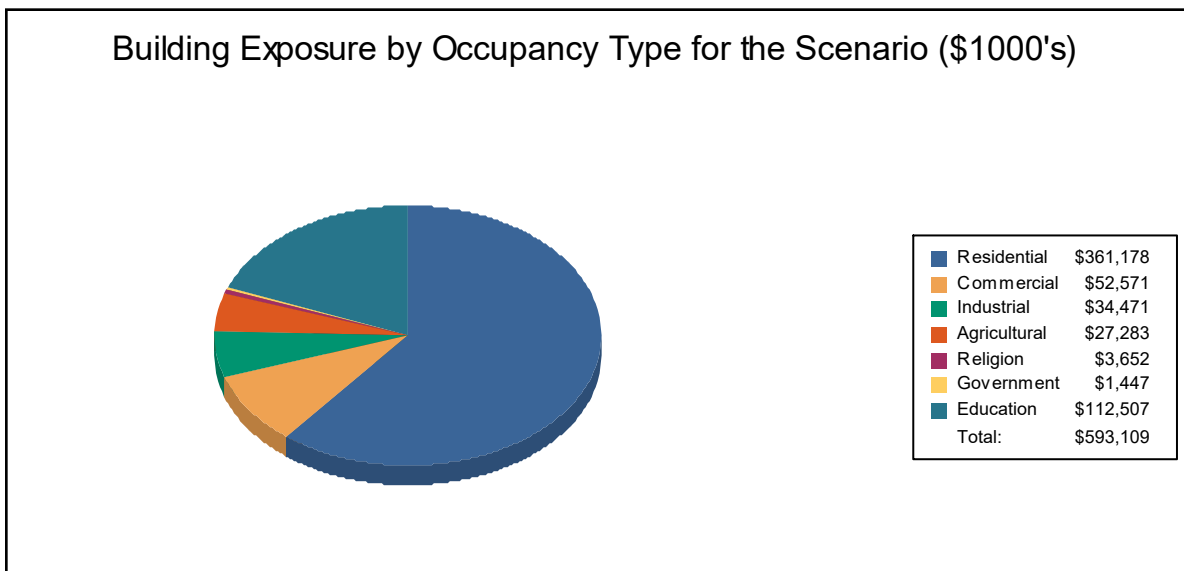
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	361,178	60.9%
Commercial	52,571	8.9%
Industrial	34,471	5.8%
Agricultural	27,283	4.6%
Religion	3,652	0.6%
Government	1,447	0.2%
Education	112,507	19.0%
<b>Total</b>	<b>593,109</b>	<b>100%</b>



### **Essential Facility Inventory**

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.  
There are 4 schools, 2 fire stations, 1 police station and 1 emergency operation center.



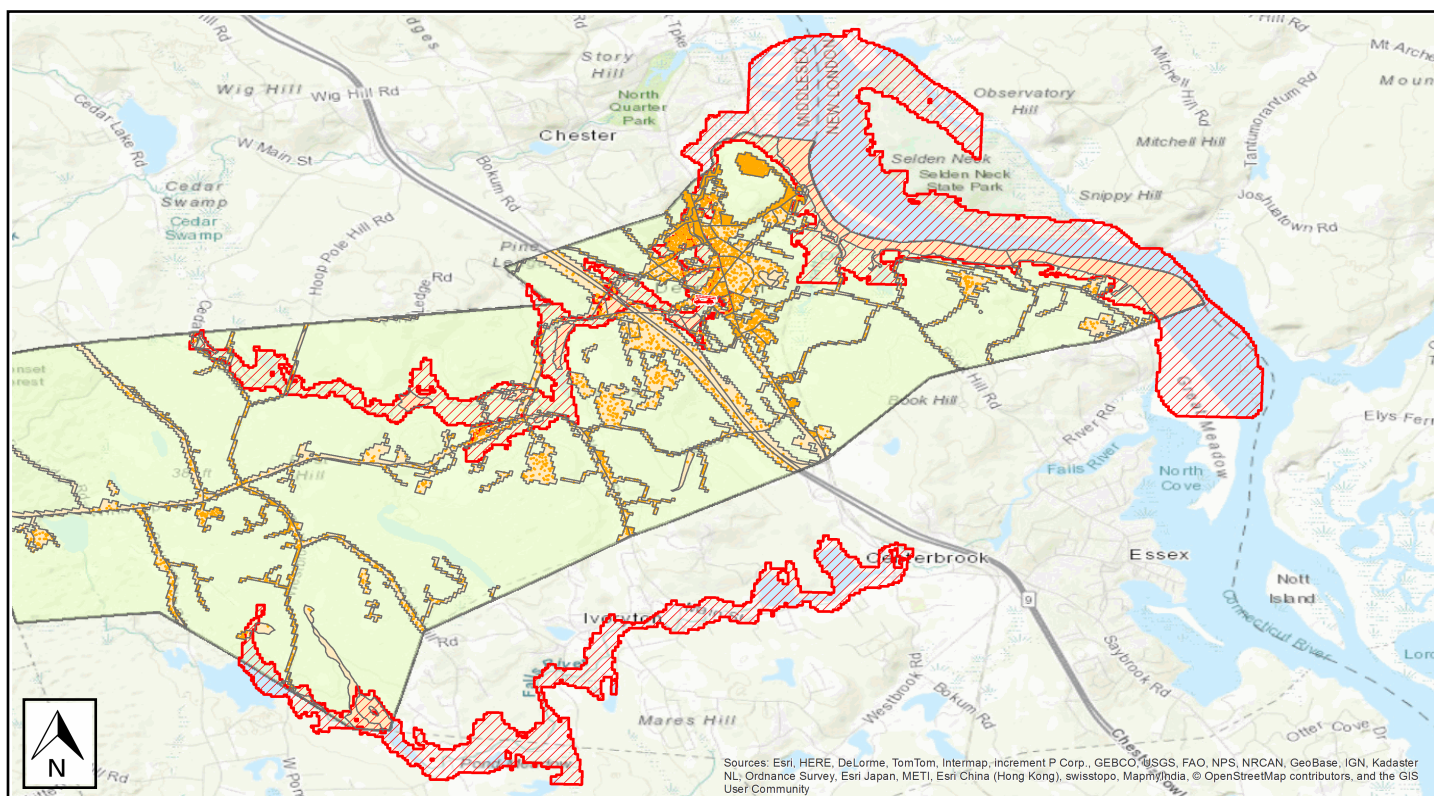
## Flood Scenario Parameters

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

<b>Study Region Name:</b>	DeepRiver
<b>Scenario Name:</b>	DeepRiverAll
<b>Return Period Analyzed:</b>	500
<b>Analysis Options Analyzed:</b>	No What-Ifs

## Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



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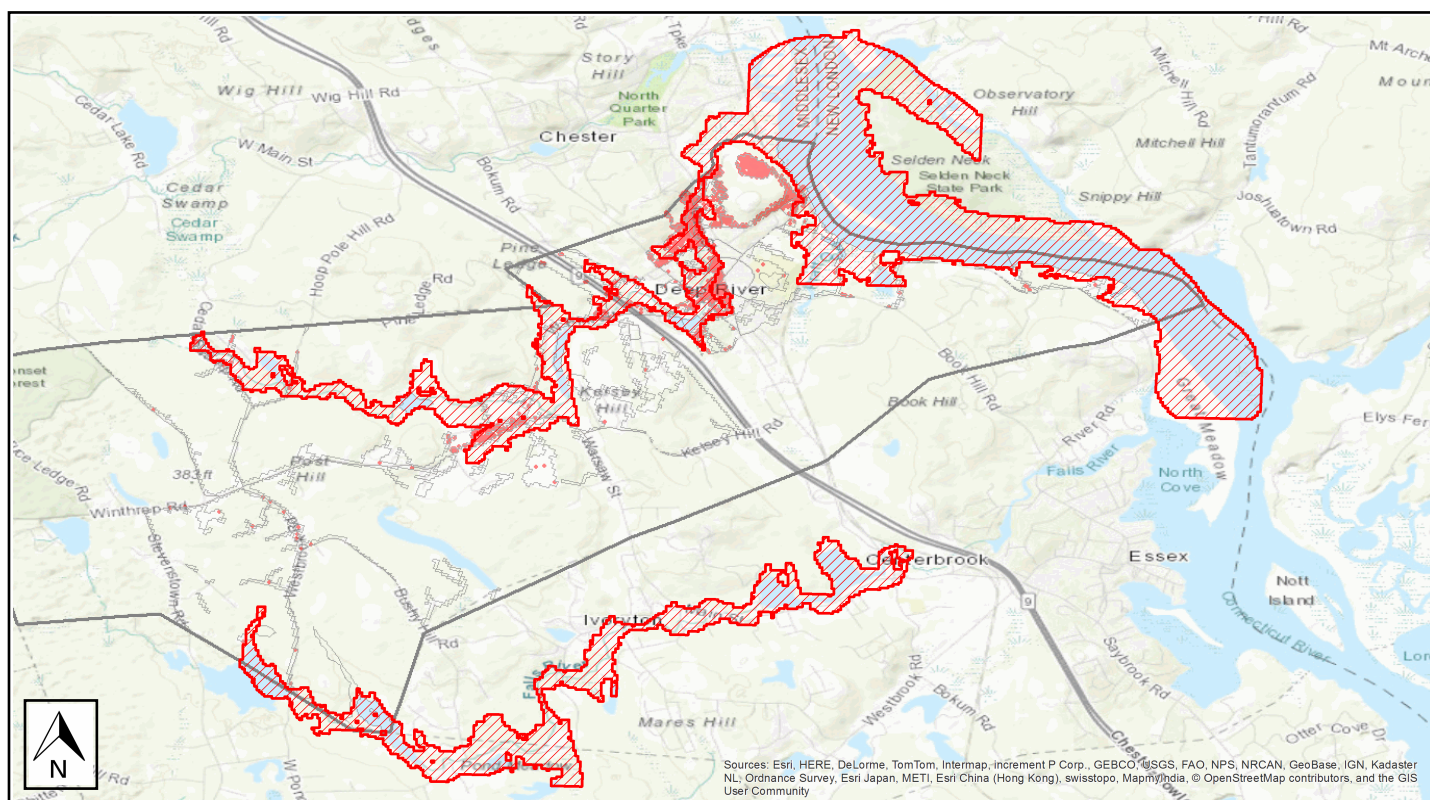


## Building Damage

### General Building Stock Damage

Hazus estimates that about 64 buildings will be at least moderately damaged. This is over 90% 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 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.

**Total Economic Loss (1 dot = \$300K) Overview Map**



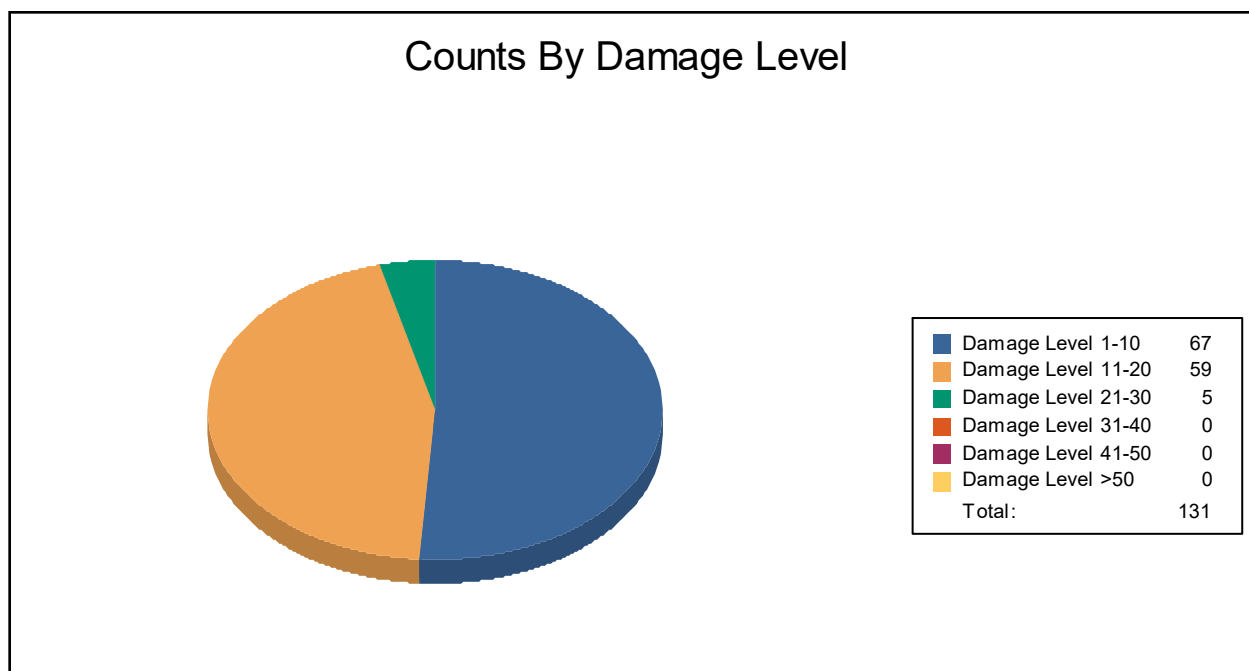
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**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	1	33	2	67	0	0	0	0	0	0	0	0
Education	1	100	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	1	100	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	65	52	56	44	5	4	0	0	0	0	0	0
<b>Total</b>	<b>67</b>		<b>59</b>		<b>5</b>		<b>0</b>		<b>0</b>		<b>0</b>	



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**Table 4: Expected Building Damage by Building Type**

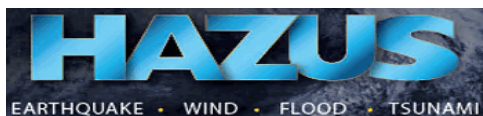
Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	2	100	0	0	0	0	0	0	0	0
Steel	0	0	2	100	0	0	0	0	0	0	0	0
Wood	65	52	55	44	5	4	0	0	0	0	0	0



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## 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
Emergency Operation Centers	1	0	0	0
Fire Stations	2	1	0	1
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	4	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.



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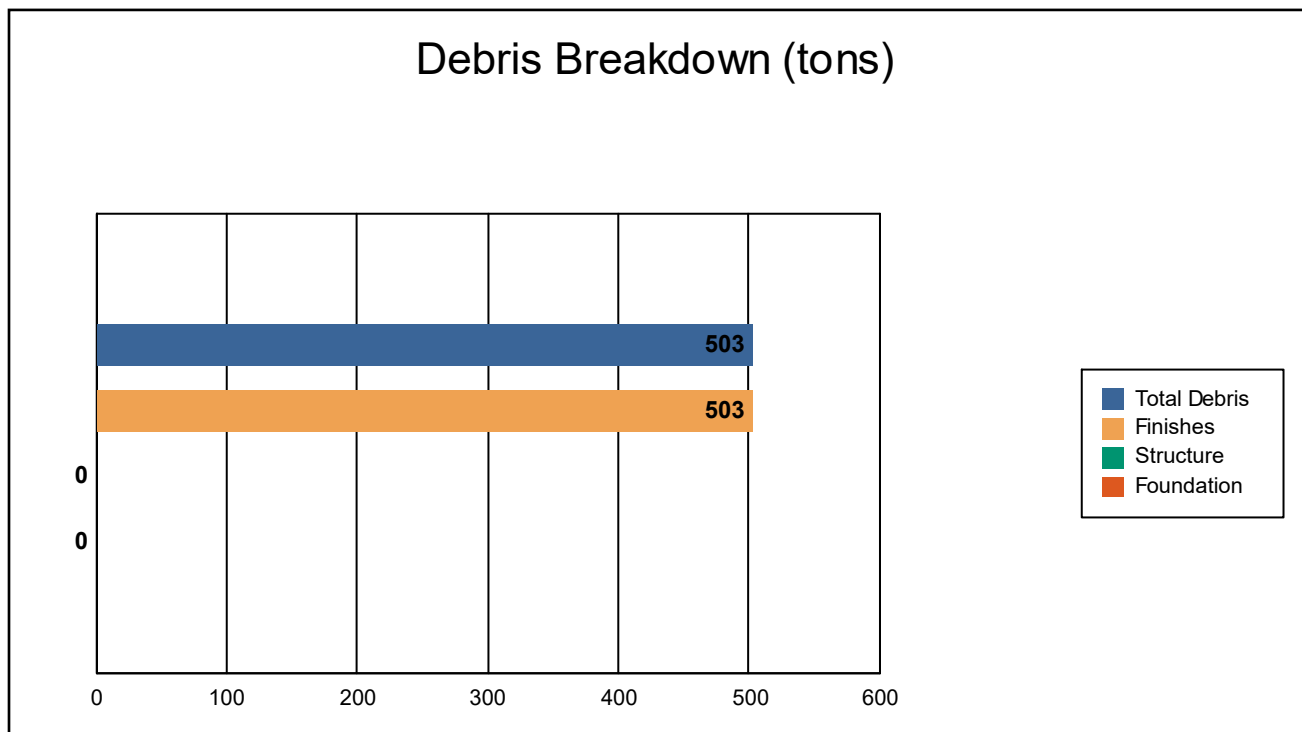
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## Induced Flood Damage

### 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 503 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 21 truckloads (@25 tons/truck) to remove the debris generated by the flood.



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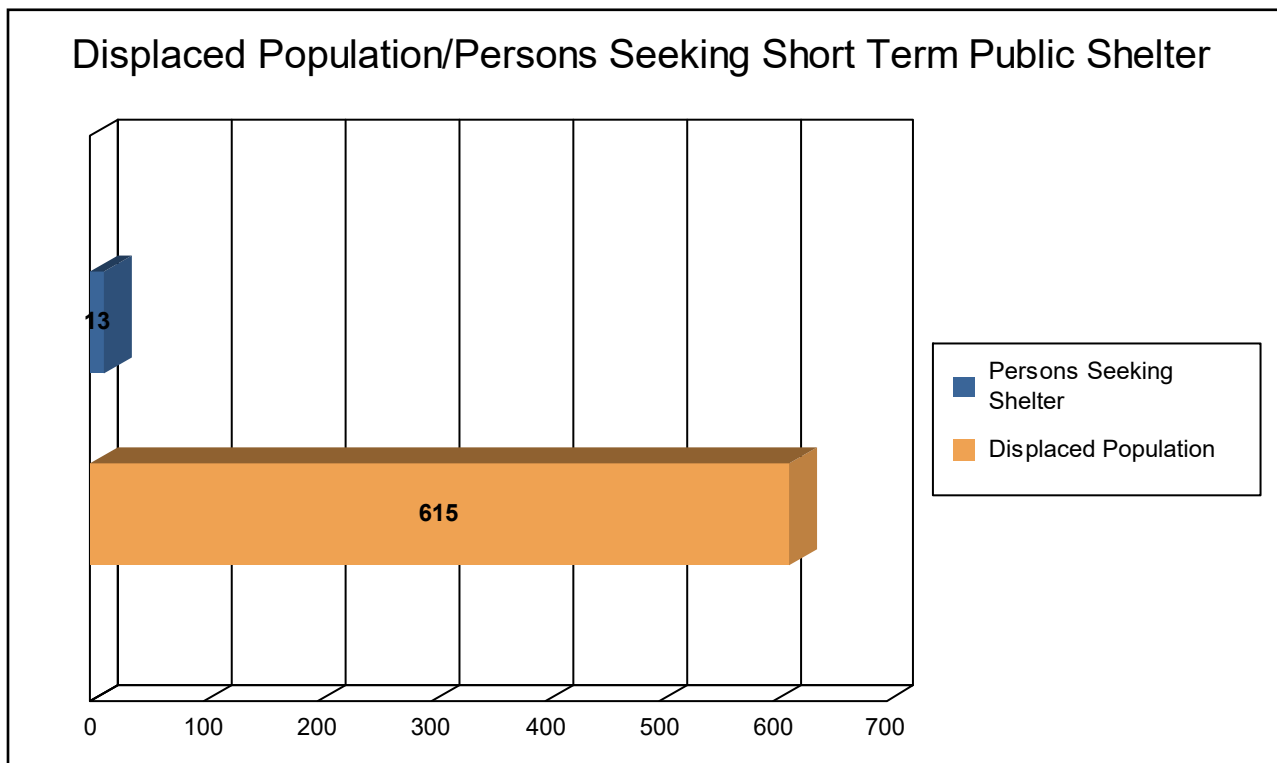
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## Social Impact

### 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 205 households (or 615 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 13 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the flood is 53.85 million dollars, which represents 9.08 % 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 26.33 million dollars. 51% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 28.78% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



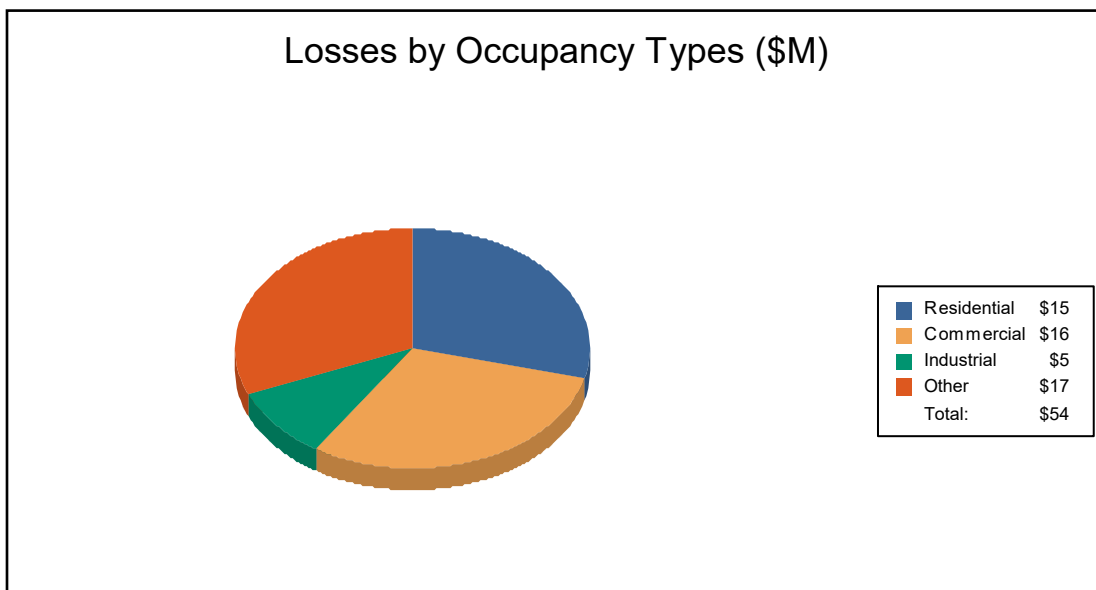
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**Table 6: Building-Related Economic Loss Estimates**  
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	7.26	1.18	1.28	0.80	10.52
	Content	3.27	4.18	3.16	4.89	15.50
	Inventory	0.00	0.02	0.26	0.02	0.30
	<b>Subtotal</b>	<b>10.53</b>	<b>5.39</b>	<b>4.71</b>	<b>5.71</b>	<b>26.33</b>
<b>Business Interruption</b>						
	Income	0.03	3.49	0.07	2.66	6.26
	Relocation	3.43	1.21	0.17	1.35	6.16
	Rental Income	1.43	0.91	0.03	0.08	2.45
	Wage	0.07	5.35	0.13	7.11	12.65
	<b>Subtotal</b>	<b>4.97</b>	<b>10.95</b>	<b>0.40</b>	<b>11.20</b>	<b>27.52</b>
<b>ALL</b>	<b>Total</b>	<b>15.50</b>	<b>16.34</b>	<b>5.11</b>	<b>16.90</b>	<b>53.85</b>



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## **Appendix A: County Listing for the Region**

Connecticut

- Middlesex



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## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Total Study Region</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 10-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

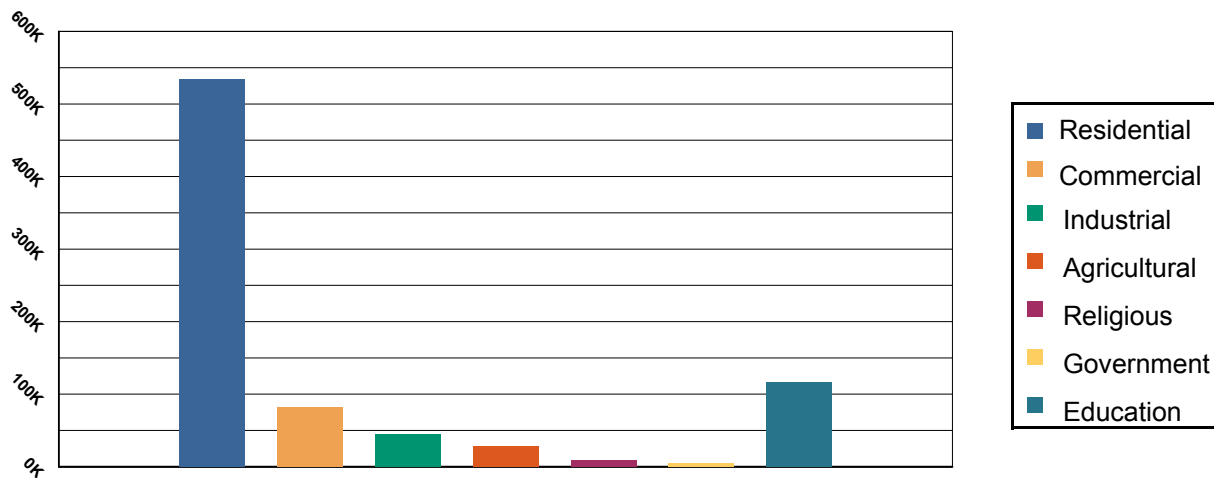


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## Hurricane Scenario

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

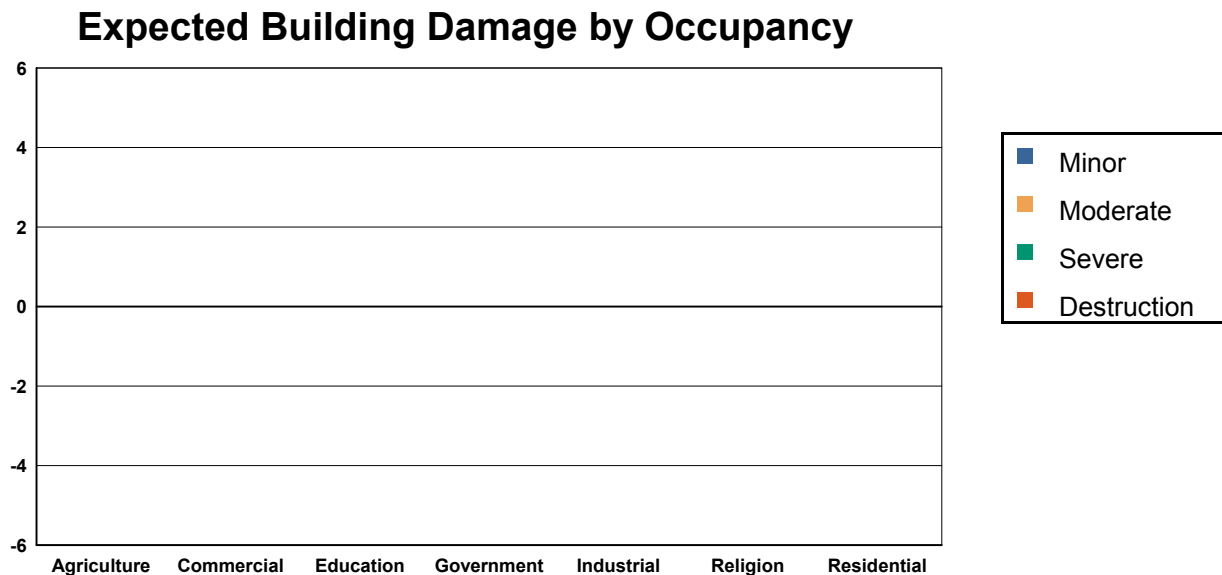
**Scenario Name:** Probabilistic

**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 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	19.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	118.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	11.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	4.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	51.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	8.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	1,786.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,997.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>	



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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	13	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	111	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	85	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	1,694	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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Thematic Map of Essential Facilities with greater than 50% moderate**

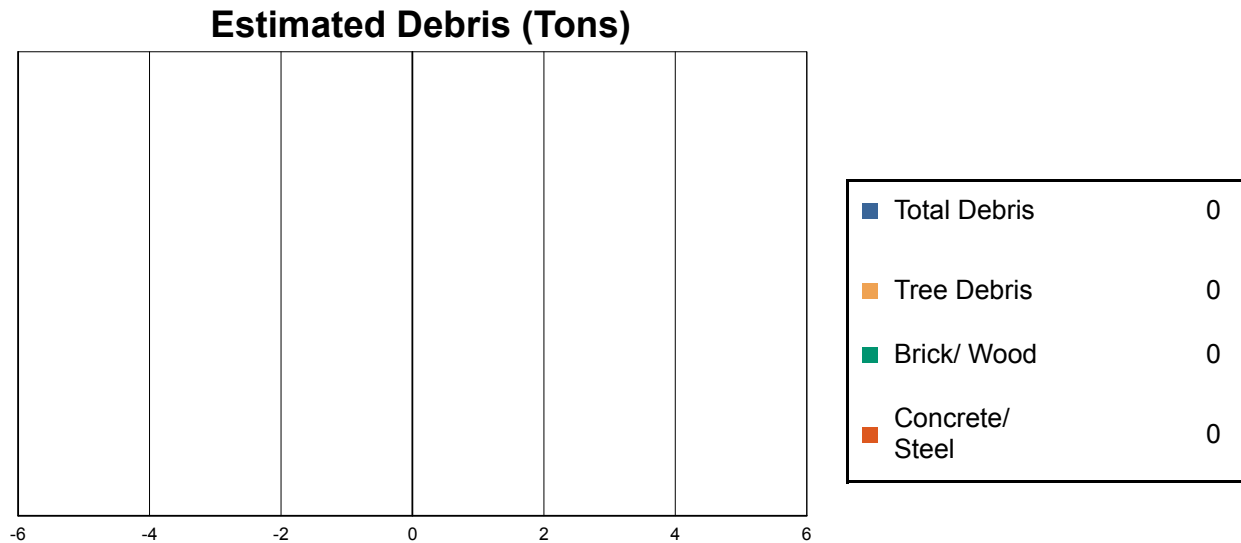


**Table 4: Expected Damage to Essential Facilities**

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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	4

## Induced Hurricane Damage

### Debris Generation

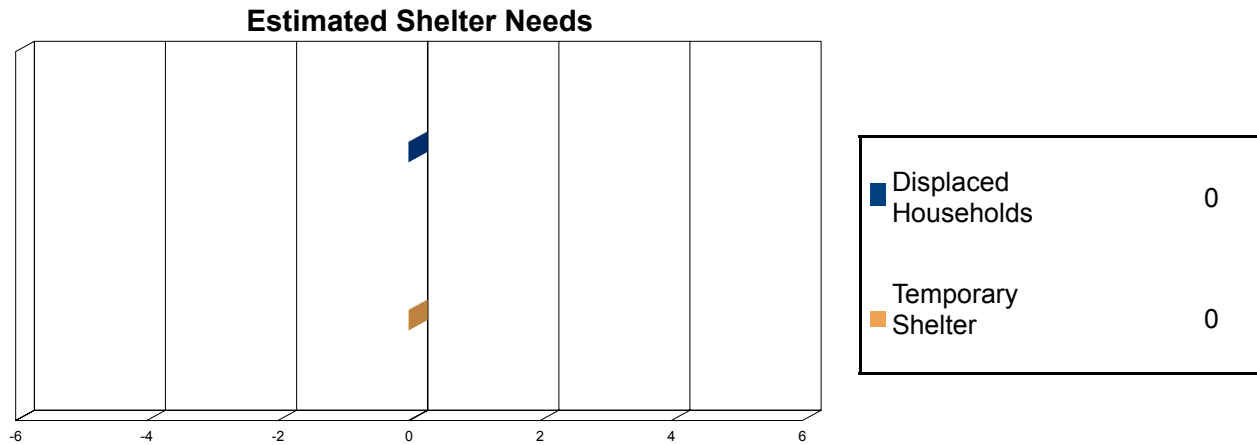


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 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 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 4,629) 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.

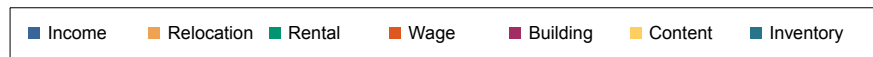
### **Building-Related Losses**

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.

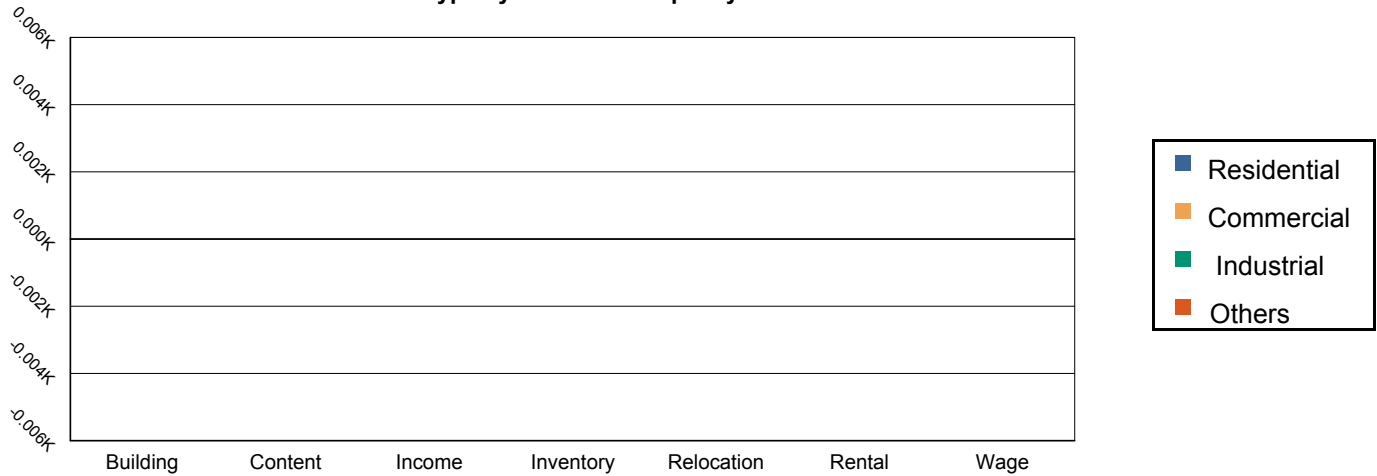
The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	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
	<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Business Interruption Loss</b>						
	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
	<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>



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Total

Total	0.00	0.00	0.00	0.00	0.00
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Study Region Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 20-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

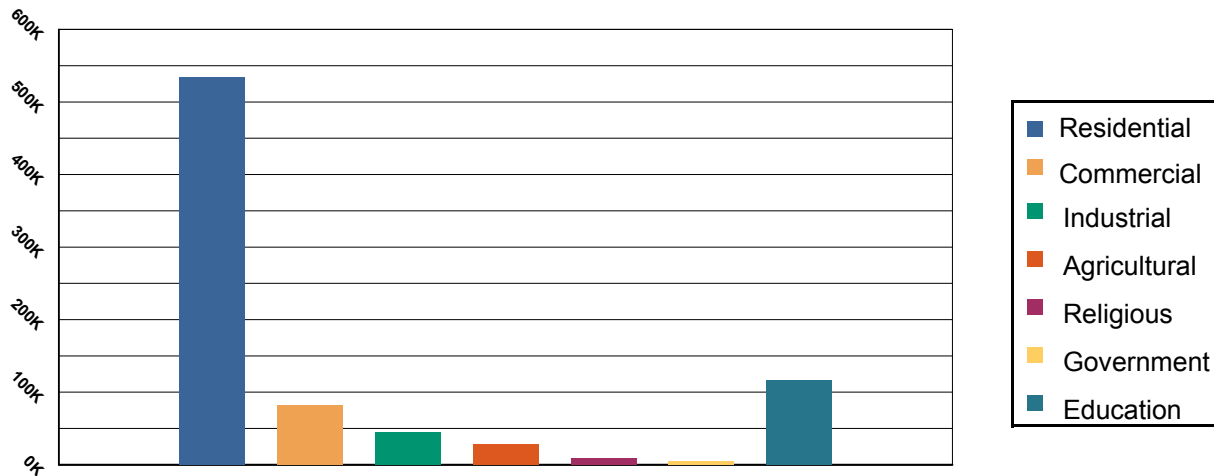


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## 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

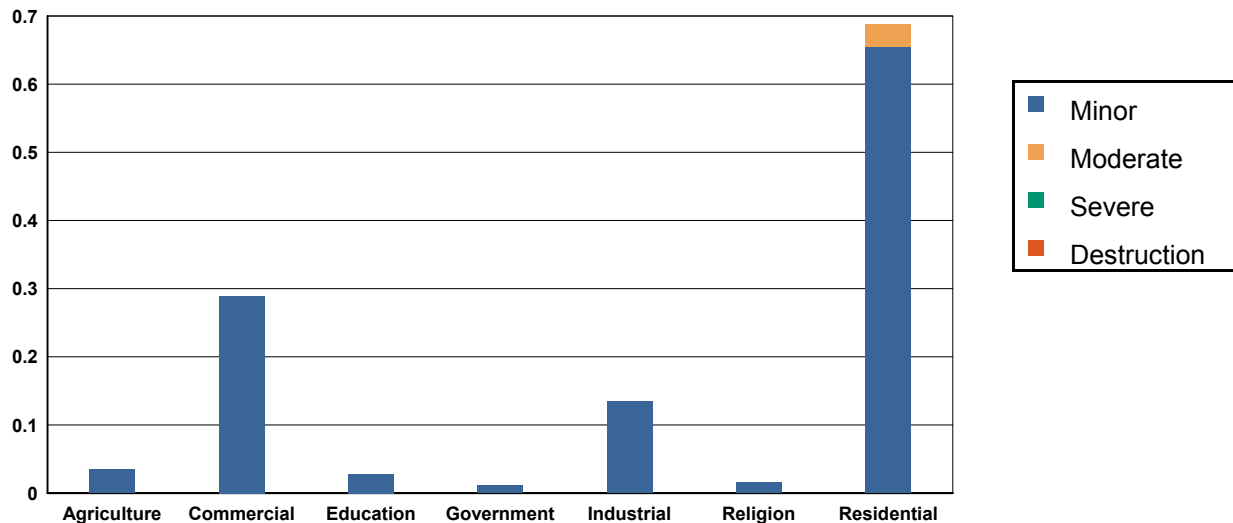
**Type:** Probabilistic

## 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 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.

**Expected Building Damage by Occupancy**



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

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18.97	99.82	0.03	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	117.71	99.75	0.29	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Education	10.97	99.74	0.03	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Government	3.99	99.73	0.01	0.27	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	50.87	99.74	0.13	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Religion	7.98	99.80	0.02	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Residential	1,785.31	99.96	0.66	0.04	0.03	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,995.80</b>		<b>1.17</b>		<b>0.03</b>		<b>0.00</b>		<b>0.00</b>	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	13	99.71	0	0.29	0	0.00	0	0.00	0	0.00
Masonry	111	99.67	0	0.32	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	85	99.73	0	0.27	0	0.00	0	0.00	0	0.00
Wood	1,694	99.98	0	0.02	0	0.00	0	0.00	0	0.00



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### **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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Thematic Map of Essential Facilities with greater than 50% moderate**

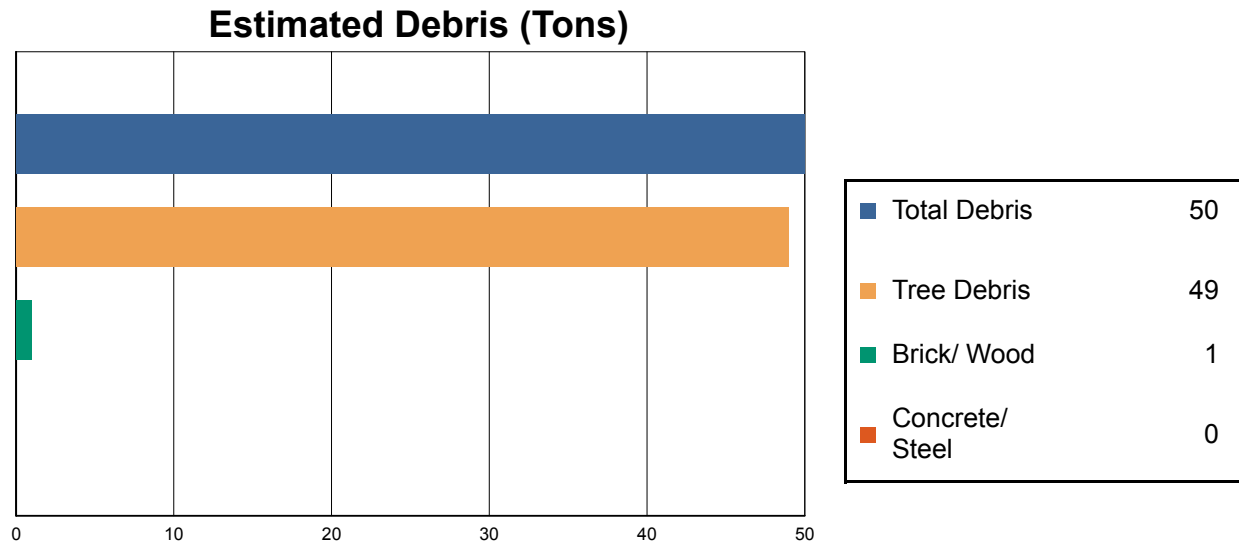


**Table 4: Expected Damage to Essential Facilities**

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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	4

## Induced Hurricane Damage

### Debris Generation

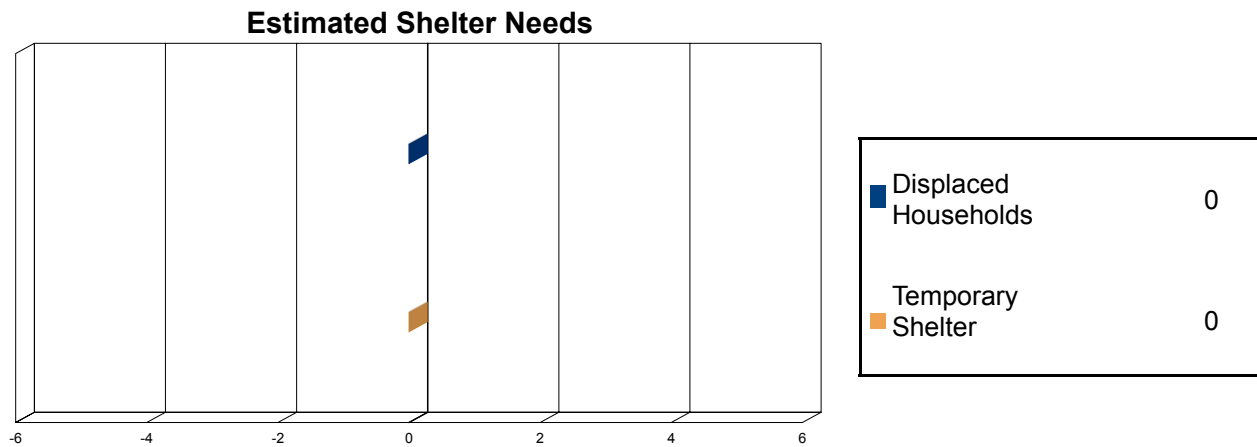


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 50 tons of debris will be generated. Of the total amount, 40 tons (80%) is Other Tree Debris. Of the remaining 10 tons, Brick/Wood comprises 10% 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 9 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 4,629) 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.

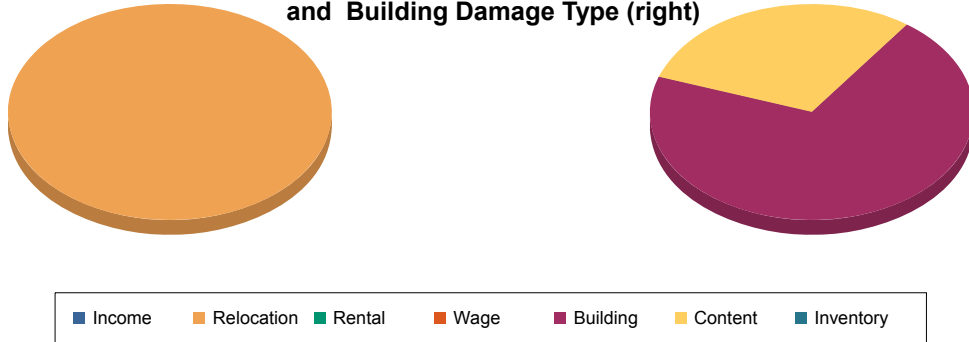
### **Building-Related Losses**

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.

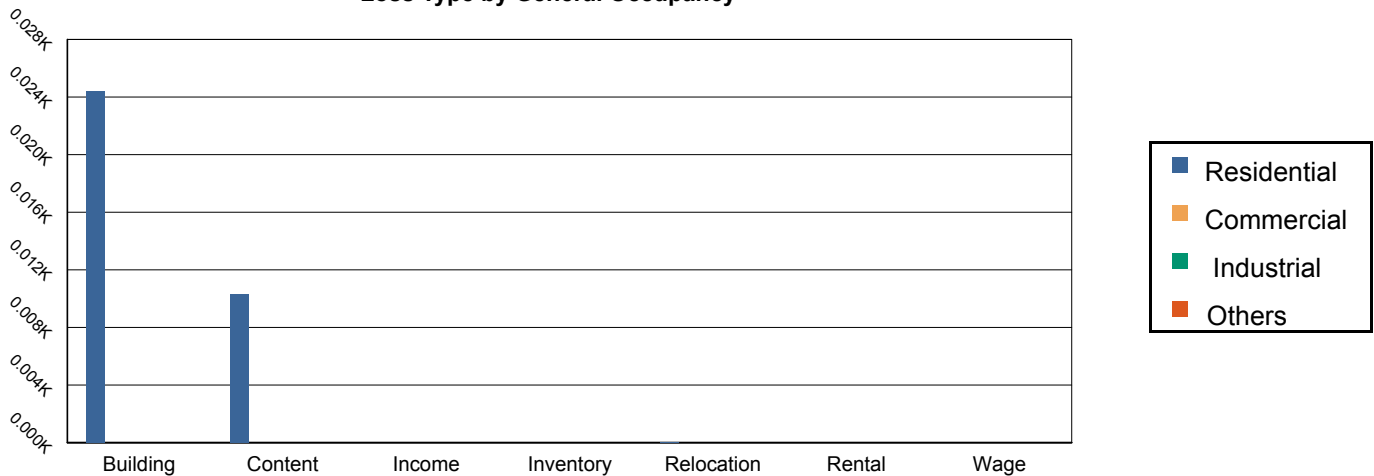
The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	24.42	0.00	0.00	0.00	24.42
	Content	10.30	0.00	0.00	0.00	10.30
	Inventory	0.00	0.00	0.00	0.00	0.00
	<b>Subtotal</b>	<b>34.72</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>34.72</b>
<b>Business Interruption Loss</b>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.06	0.00	0.00	0.00	0.06
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	<b>Subtotal</b>	<b>0.06</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.06</b>



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Total

Total	34.78	0.00	0.00	0.00	34.78
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Study Region Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 50-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

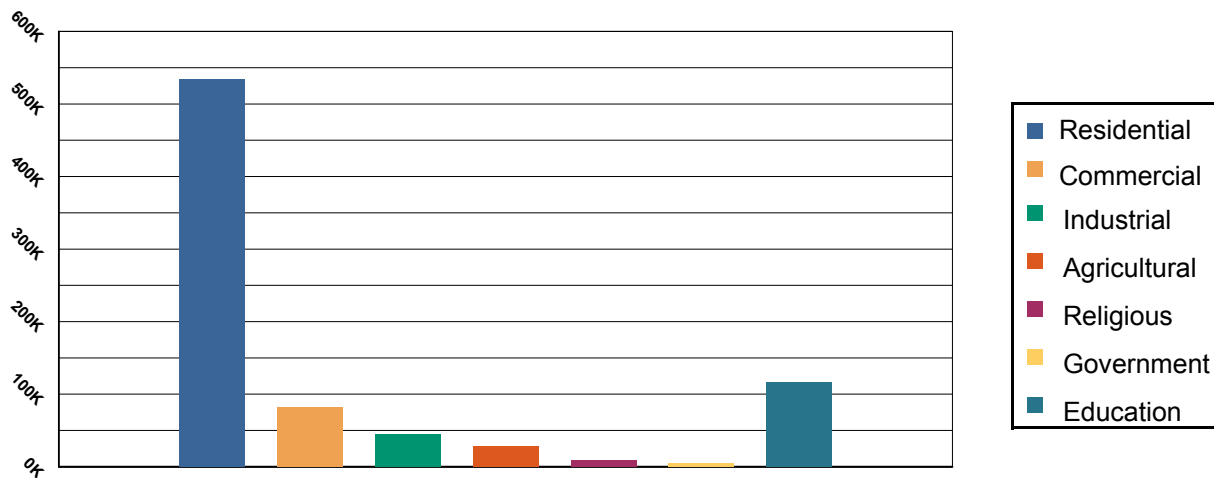


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## 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 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.

### Expected Building Damage by Occupancy

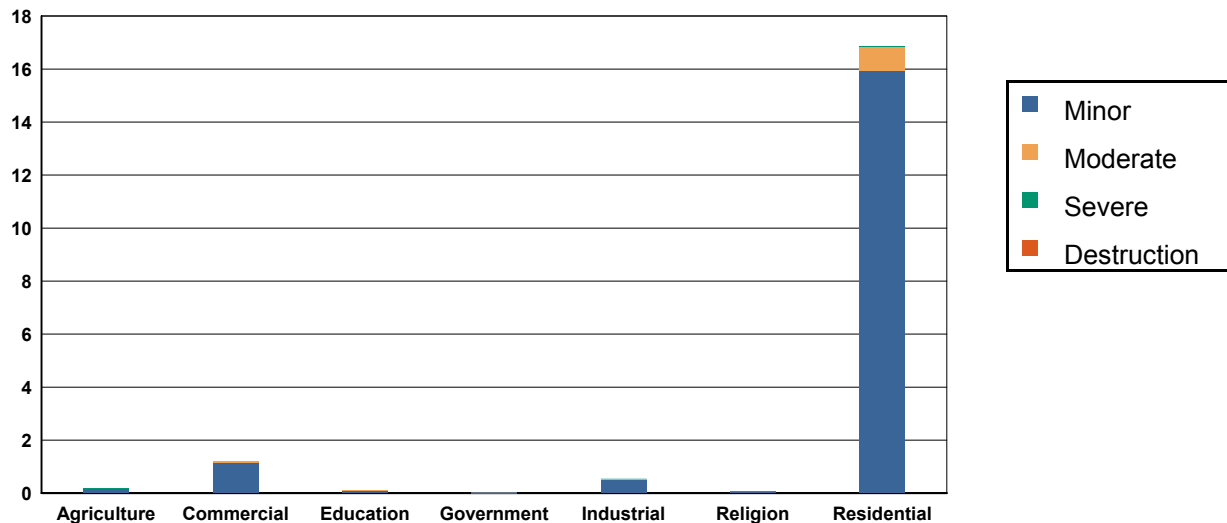


Table 2: Expected Building Damage by Occupancy : 50 - year Event

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18.81	99.02	0.17	0.91	0.01	0.06	0.00	0.01	0.00	0.00
Commercial	116.79	98.98	1.14	0.97	0.06	0.05	0.00	0.00	0.00	0.00
Education	10.89	98.97	0.11	1.02	0.00	0.01	0.00	0.00	0.00	0.00
Government	3.96	98.96	0.04	1.03	0.00	0.01	0.00	0.00	0.00	0.00
Industrial	50.46	98.95	0.52	1.02	0.01	0.03	0.00	0.00	0.00	0.00
Religion	7.94	99.19	0.06	0.79	0.00	0.02	0.00	0.00	0.00	0.00
Residential	1,769.15	99.06	15.94	0.89	0.87	0.05	0.03	0.00	0.00	0.00
<b>Total</b>	<b>1,978.00</b>		<b>18.00</b>		<b>0.96</b>		<b>0.03</b>		<b>0.00</b>	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	13	98.92	0	1.08	0	0.00	0	0.00	0	0.00
Masonry	109	98.02	2	1.70	0	0.27	0	0.01	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	84	98.97	1	1.00	0	0.03	0	0.00	0	0.00
Wood	1,681	99.22	13	0.76	0	0.02	0	0.00	0	0.00



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### **Essential Facility Damage**

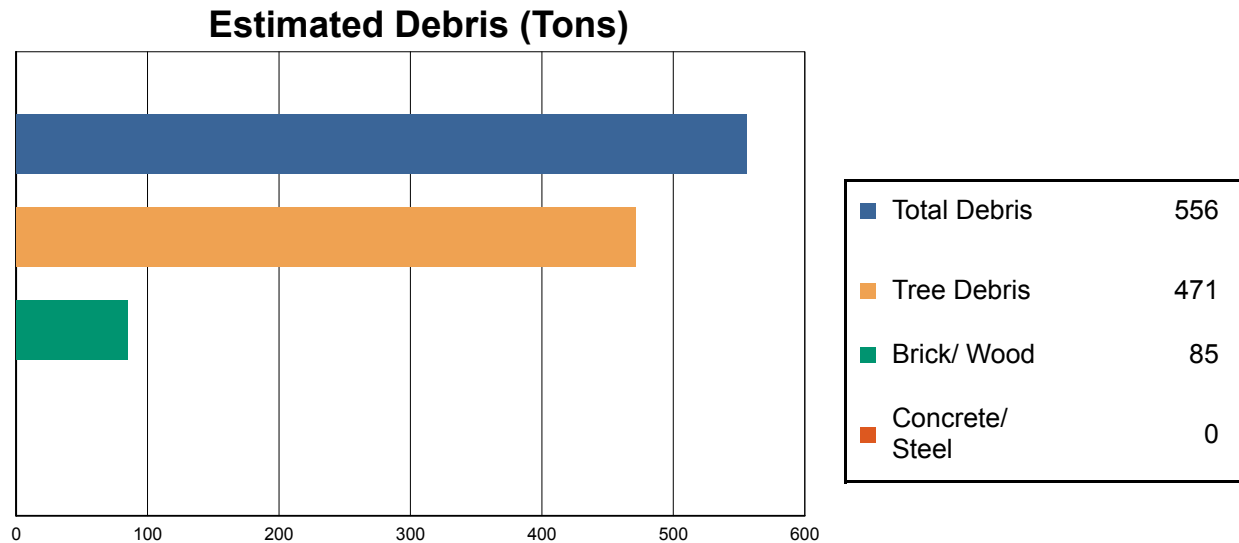
Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30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

# 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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	4

## Induced Hurricane Damage

### Debris Generation

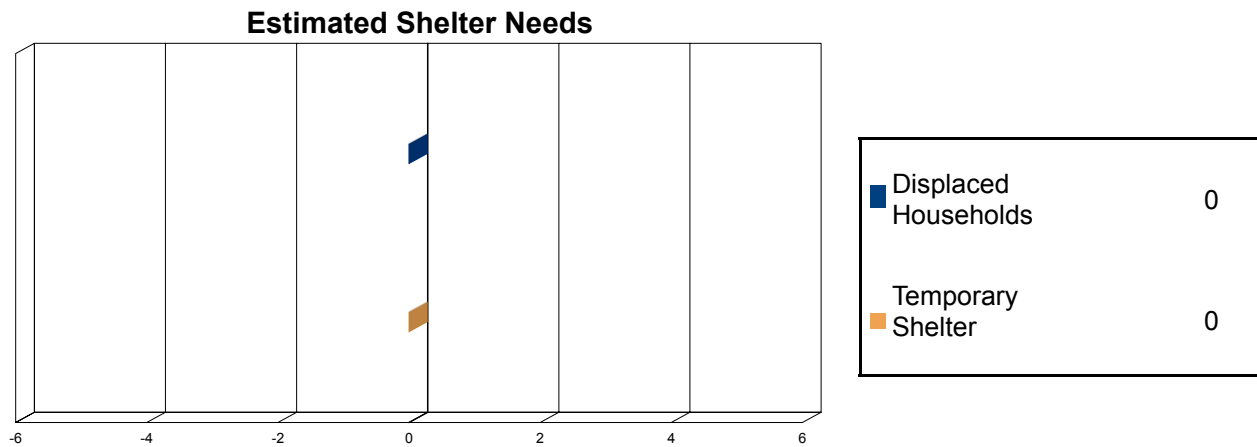


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 556 tons of debris will be generated. Of the total amount, 385 tons (69%) is Other Tree Debris. Of the remaining 171 tons, Brick/Wood comprises 50% 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 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 86 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 4,629) will seek temporary shelter in public shelters.



## Economic Loss

The total economic loss estimated for the hurricane is 1.3 million dollars, which represents 0.15 % of the total replacement value of the region's buildings.

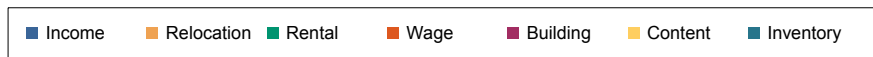
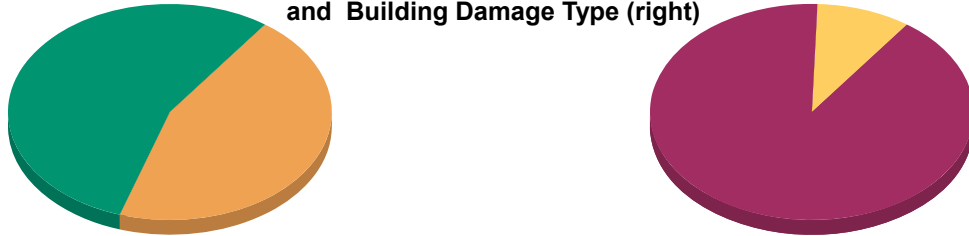
### **Building-Related Losses**

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.

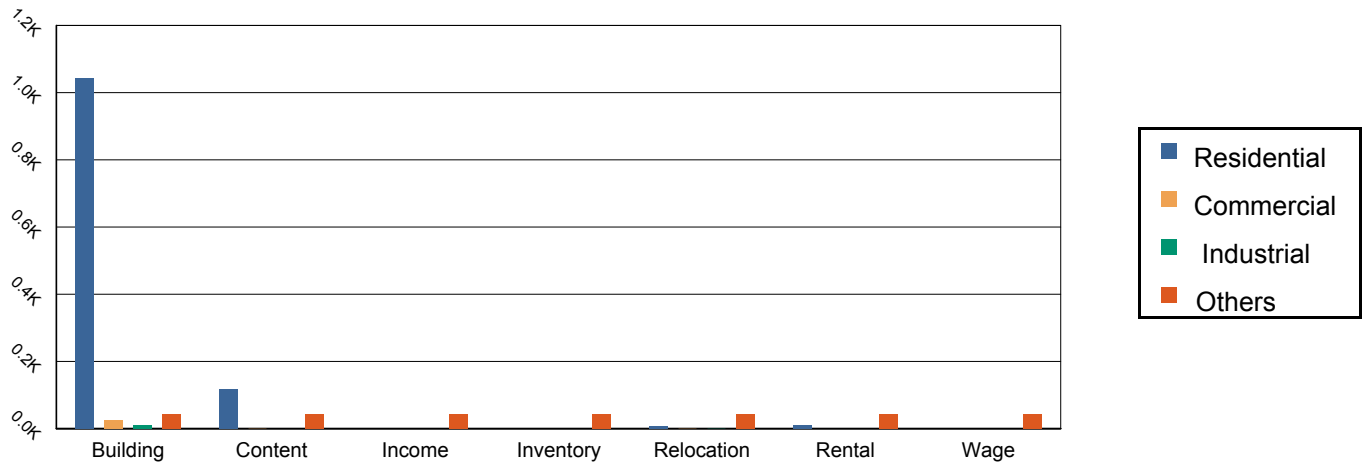
The total property damage losses were 1 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 94% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	1,043.88	26.73	10.17	44.13	1,124.91
	Content	116.61	0.07	0.00	0.00	116.69
	Inventory	0.00	0.00	0.00	0.00	0.00
	<b>Subtotal</b>	<b>1,160.49</b>	<b>26.80</b>	<b>10.17</b>	<b>44.13</b>	<b>1,241.60</b>
<b>Business Interruption Loss</b>						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	8.36	0.28	0.05	0.19	8.89
	Rental	10.82	0.00	0.00	0.00	10.82
	Wage	0.00	0.00	0.00	0.00	0.00
	<b>Subtotal</b>	<b>19.18</b>	<b>0.28</b>	<b>0.05</b>	<b>0.19</b>	<b>19.71</b>



Total

Total	1,179.67	27.09	10.23	44.32	1,261.31
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	4,629	534,584	284,620	819,204
Total	4,629	534,584	284,620	819,204
Study Region Total	4,629	534,584	284,620	819,204



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Increasing Resilience Together

# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 100-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

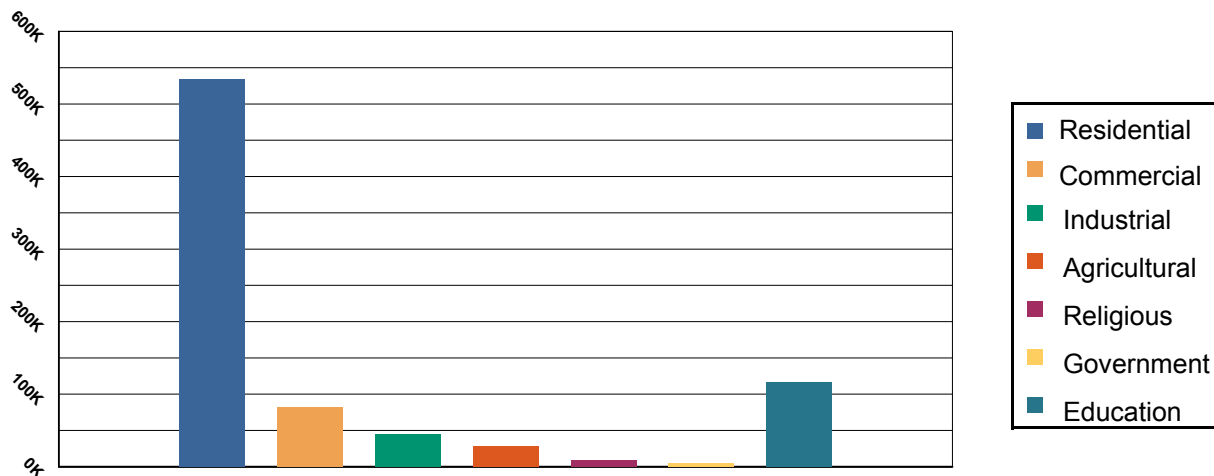


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## Hurricane Scenario

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

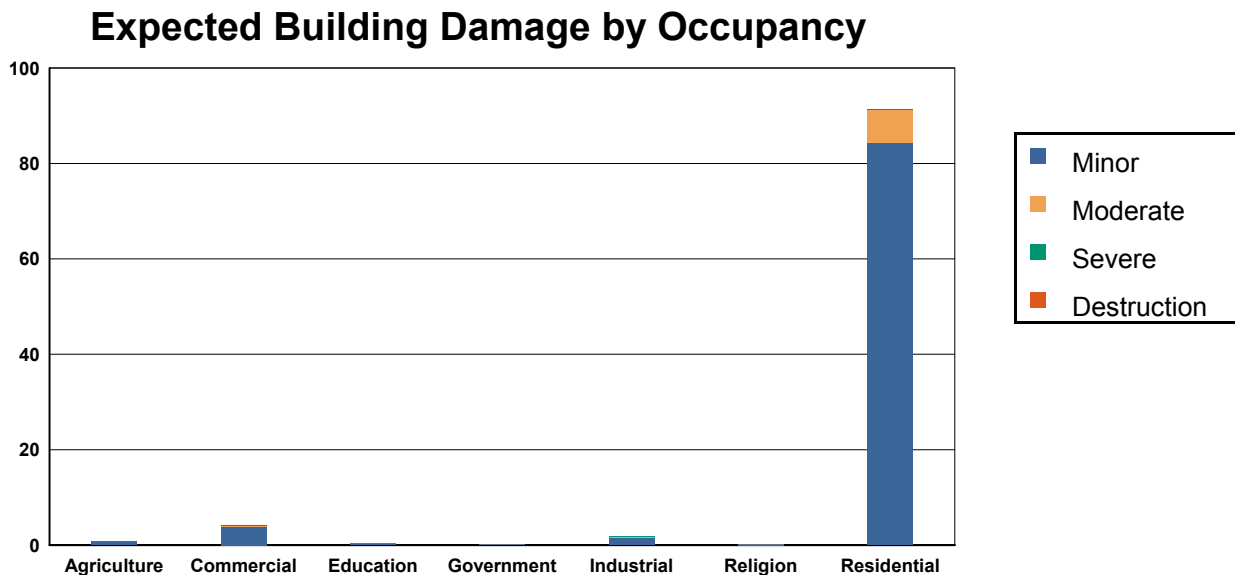
**Scenario Name:** Probabilistic

**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 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	18.15	95.54	0.70	3.68	0.11	0.56	0.04	0.22	0.00	0.00
Commercial	113.76	96.41	3.80	3.22	0.41	0.35	0.03	0.02	0.00	0.00
Education	10.61	96.49	0.37	3.35	0.02	0.16	0.00	0.00	0.00	0.00
Government	3.87	96.65	0.13	3.22	0.01	0.14	0.00	0.00	0.00	0.00
Industrial	49.21	96.48	1.61	3.16	0.14	0.28	0.04	0.07	0.00	0.00
Religion	7.75	96.90	0.24	2.98	0.01	0.11	0.00	0.01	0.00	0.00
Residential	1,694.66	94.89	84.44	4.73	6.75	0.38	0.15	0.01	0.00	0.00
<b>Total</b>	<b>1,898.01</b>		<b>91.29</b>		<b>7.44</b>		<b>0.26</b>		<b>0.00</b>	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	13	96.80	0	3.08	0	0.12	0	0.00	0	0.00
Masonry	104	93.45	5	4.91	2	1.52	0	0.12	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	82	96.80	2	2.91	0	0.27	0	0.03	0	0.00
Wood	1,614	95.25	77	4.53	4	0.21	0	0.01	0	0.00



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### **Essential Facility Damage**

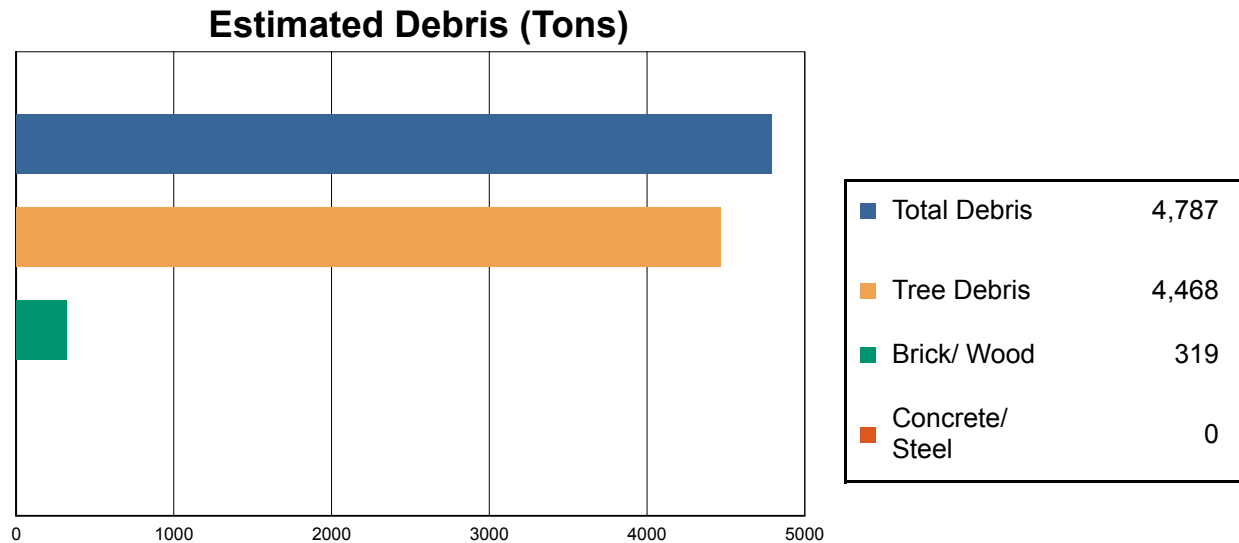
Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30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

# 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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	4

## Induced Hurricane Damage

### Debris Generation

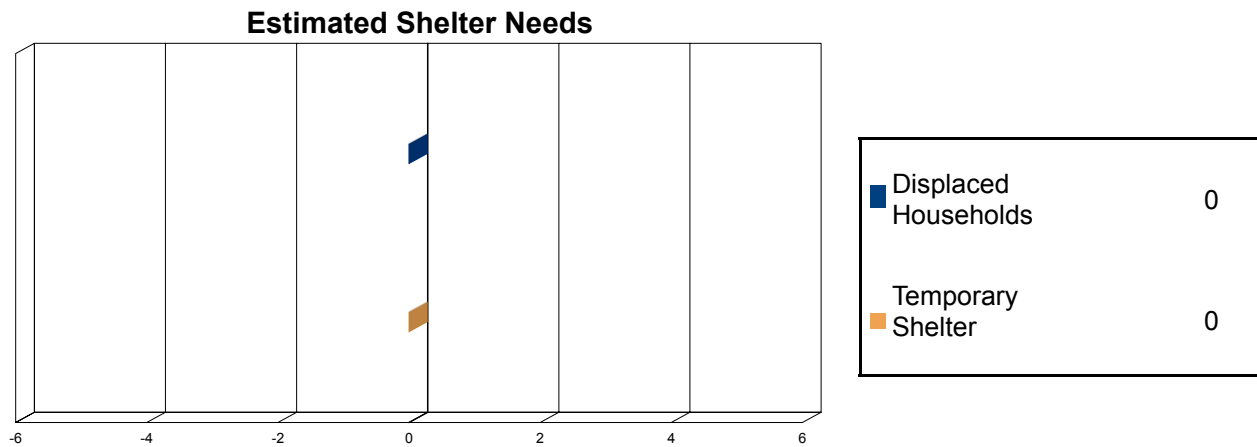


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 4,787 tons of debris will be generated. Of the total amount, 3,655 tons (76%) is Other Tree Debris. Of the remaining 1,132 tons, Brick/Wood comprises 28% 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 13 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 813 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 4,629) will seek temporary shelter in public shelters.



## Economic Loss

The total economic loss estimated for the hurricane is 3.8 million dollars, which represents 0.47 % of the total replacement value of the region's buildings.

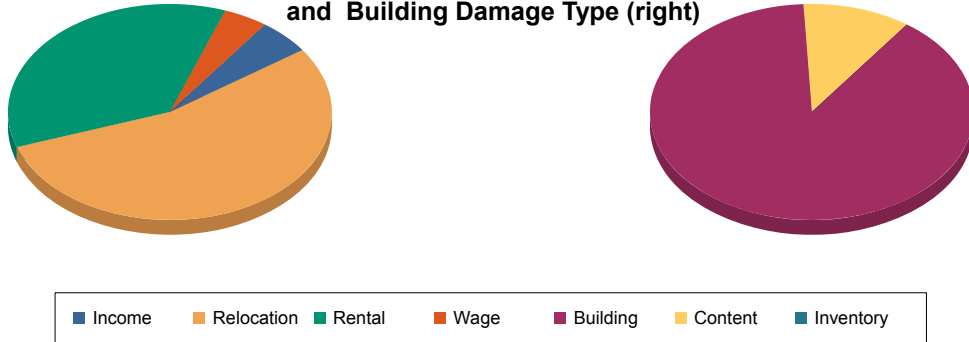
### **Building-Related Losses**

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.

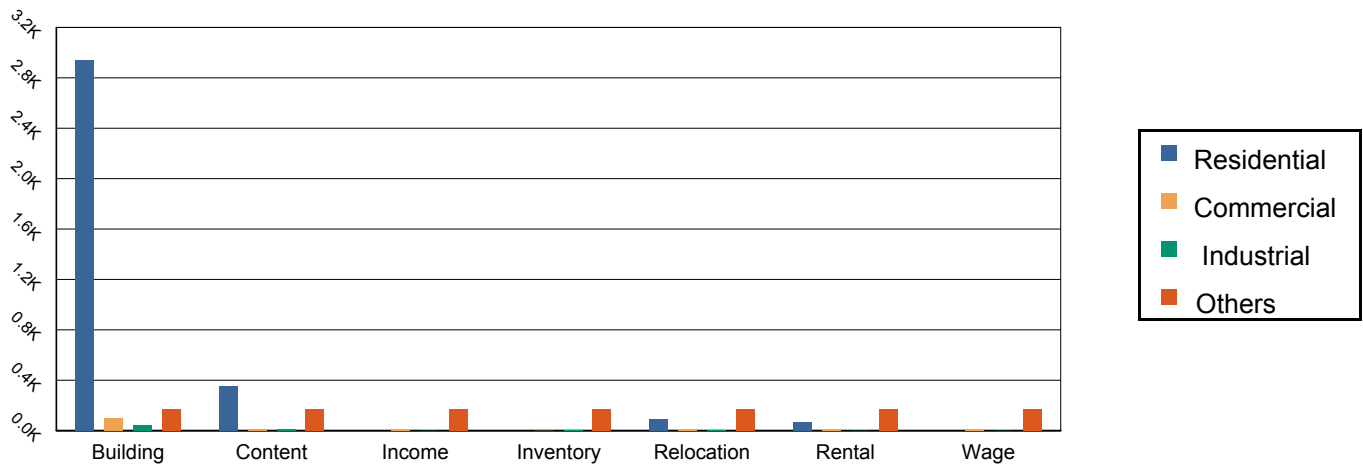
The total property damage losses were 4 million dollars. 5% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	2,939.31	97.41	44.39	144.86	3,225.97
	Content	354.08	11.19	12.24	12.89	390.40
	Inventory	0.00	0.19	1.69	1.11	2.98
	<b>Subtotal</b>	<b>3,293.39</b>	<b>108.78</b>	<b>58.32</b>	<b>158.86</b>	<b>3,619.35</b>
<b>Business Interruption Loss</b>						
	Income	0.00	7.36	0.27	2.33	9.96
	Relocation	93.75	6.16	1.31	3.61	104.84
	Rental	64.88	3.39	0.23	0.15	68.65
	Wage	0.00	2.62	0.45	5.47	8.53
	<b>Subtotal</b>	<b>158.63</b>	<b>19.52</b>	<b>2.26</b>	<b>11.57</b>	<b>191.98</b>



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Total

Total	3,452.02	128.31	60.58	170.42	3,811.33
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Study Region Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 200-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

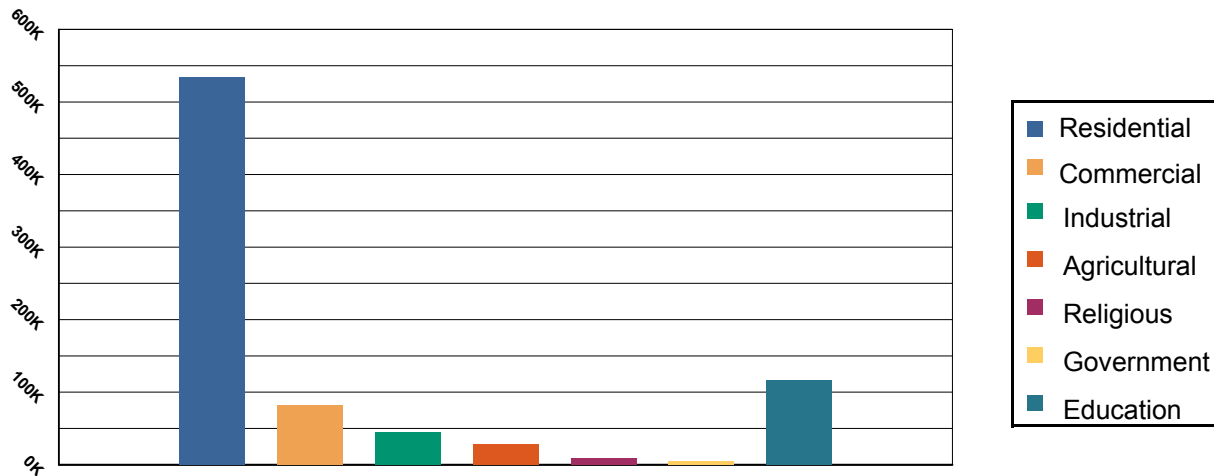


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## Hurricane Scenario

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

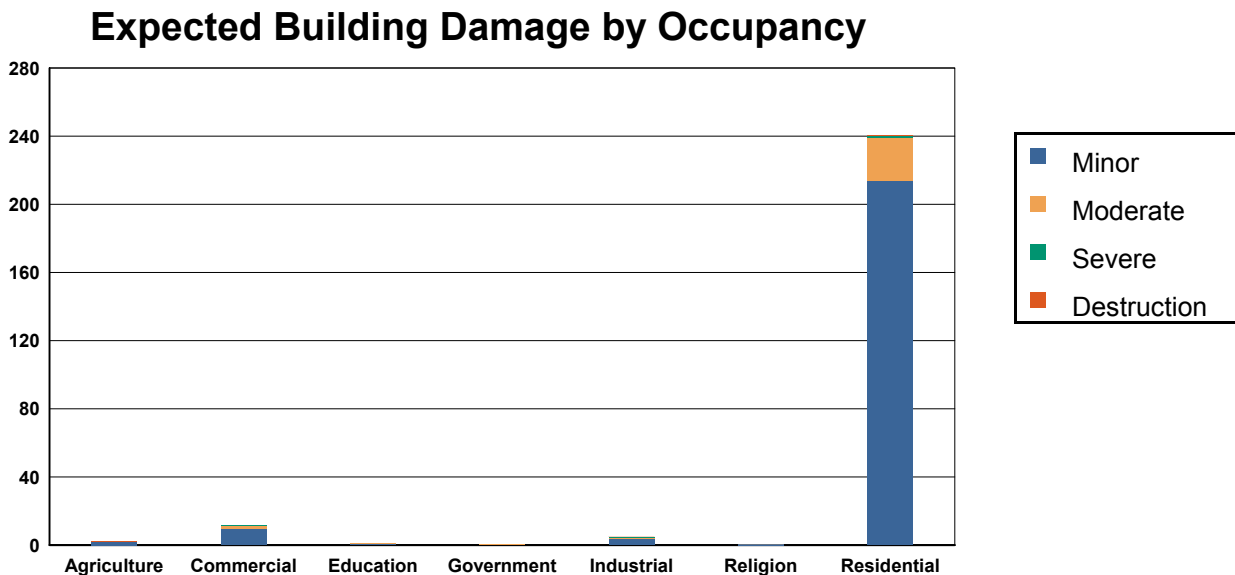
**Scenario Name:** Probabilistic

**Type:** Probabilistic

## Building Damage

### General Building Stock Damage

Hazus estimates that about 30 buildings will be at least moderately damaged. This is over 2% 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 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	16.67	87.72	1.77	9.31	0.38	1.98	0.17	0.92	0.01	0.08
Commercial	106.61	90.35	9.61	8.14	1.60	1.36	0.18	0.15	0.00	0.00
Education	9.93	90.31	0.94	8.55	0.12	1.10	0.00	0.04	0.00	0.00
Government	3.63	90.86	0.32	8.09	0.04	1.02	0.00	0.03	0.00	0.00
Industrial	46.21	90.60	3.92	7.70	0.68	1.34	0.17	0.34	0.01	0.02
Religion	7.29	91.18	0.65	8.12	0.05	0.67	0.00	0.03	0.00	0.00
Residential	1,545.60	86.54	213.86	11.97	25.58	1.43	0.73	0.04	0.24	0.01
<b>Total</b>	<b>1,735.94</b>		<b>231.07</b>		<b>28.45</b>		<b>1.26</b>		<b>0.26</b>	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	12	91.56	1	7.51	0	0.92	0	0.02	0	0.00
Masonry	95	85.16	11	10.16	5	4.14	1	0.51	0	0.04
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	78	91.47	6	7.10	1	1.24	0	0.19	0	0.00
Wood	1,474	87.03	201	11.88	18	1.04	1	0.04	0	0.01



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### **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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Thematic Map of Essential Facilities with greater than 50% moderate**

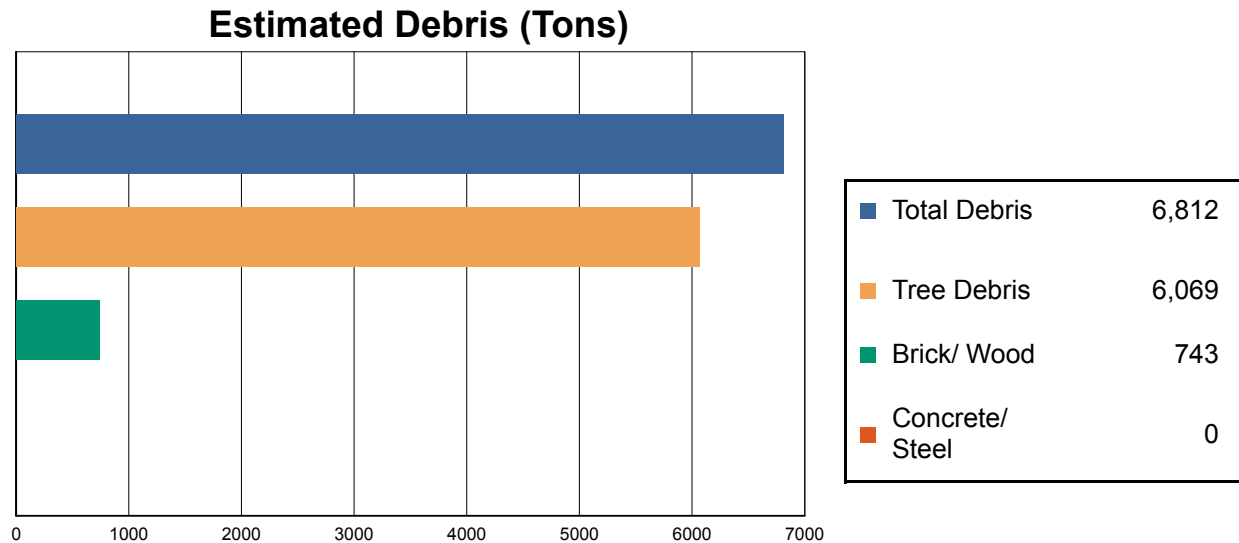


**Table 4: Expected Damage to Essential Facilities**

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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	4

## Induced Hurricane Damage

### Debris Generation

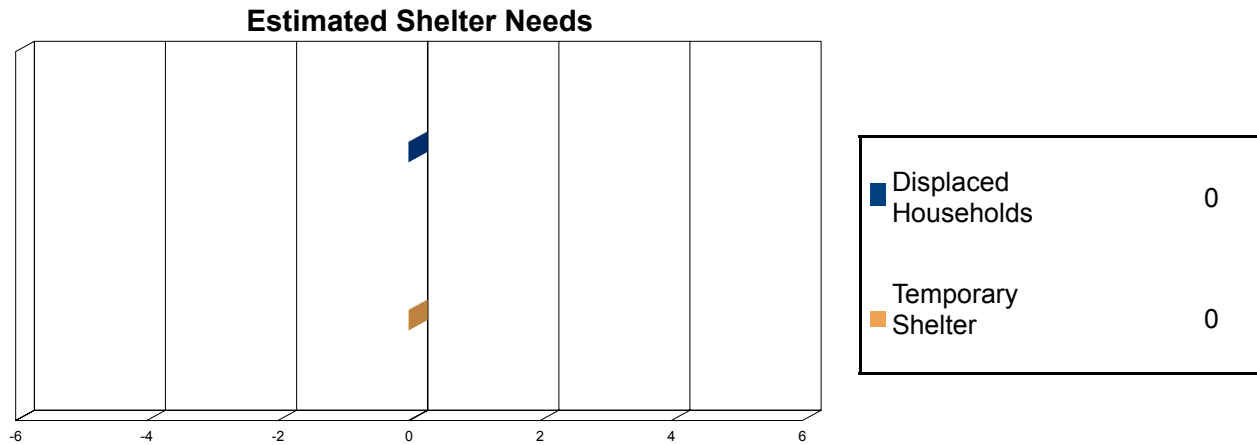


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 6,812 tons of debris will be generated. Of the total amount, 4,965 tons (73%) is Other Tree Debris. Of the remaining 1,847 tons, Brick/Wood comprises 40% 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 30 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 1,104 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 4,629) will seek temporary shelter in public shelters.



## Economic Loss

The total economic loss estimated for the hurricane is 8.7 million dollars, which represents 1.06 % of the total replacement value of the region's buildings.

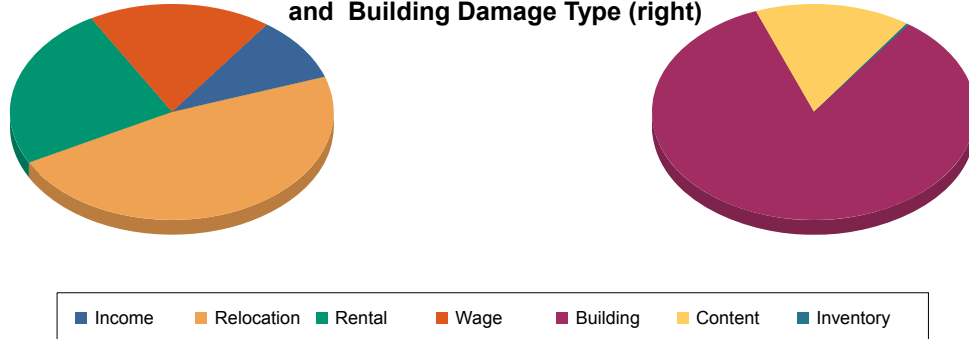
### **Building-Related Losses**

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.

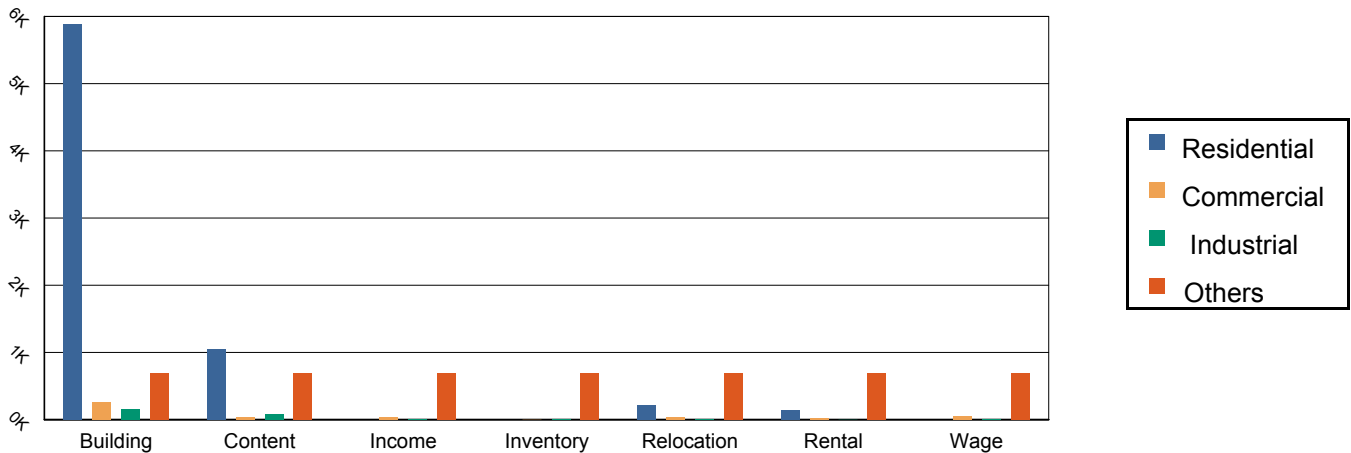
The total property damage losses were 9 million dollars. 8% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 84% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	5,880.67	254.81	151.98	442.72	6,730.17
	Content	1,042.32	43.29	75.88	84.63	1,246.12
	Inventory	0.00	0.82	9.59	5.04	15.45
	<b>Subtotal</b>	<b>6,922.99</b>	<b>298.93</b>	<b>237.45</b>	<b>532.38</b>	<b>7,991.75</b>
<b>Business Interruption Loss</b>						
	Income	0.00	39.98	2.01	25.91	67.90
	Relocation	216.88	42.85	9.10	56.85	325.67
	Rental	136.93	27.39	1.71	2.97	169.01
	Wage	0.00	48.65	3.36	74.75	126.76
	<b>Subtotal</b>	<b>353.81</b>	<b>158.87</b>	<b>16.18</b>	<b>160.48</b>	<b>689.34</b>



Total

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Total	7,276.80	457.79	253.63	692.86	8,681.09
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
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Middlesex	4,629	534,584	284,620	819,204
Total	4,629	534,584	284,620	819,204
Study Region Total	4,629	534,584	284,620	819,204



# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 500-year Return Period

**Print Date:** Tuesday, October 1, 2019

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

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## Building Inventory

### General Building Stock

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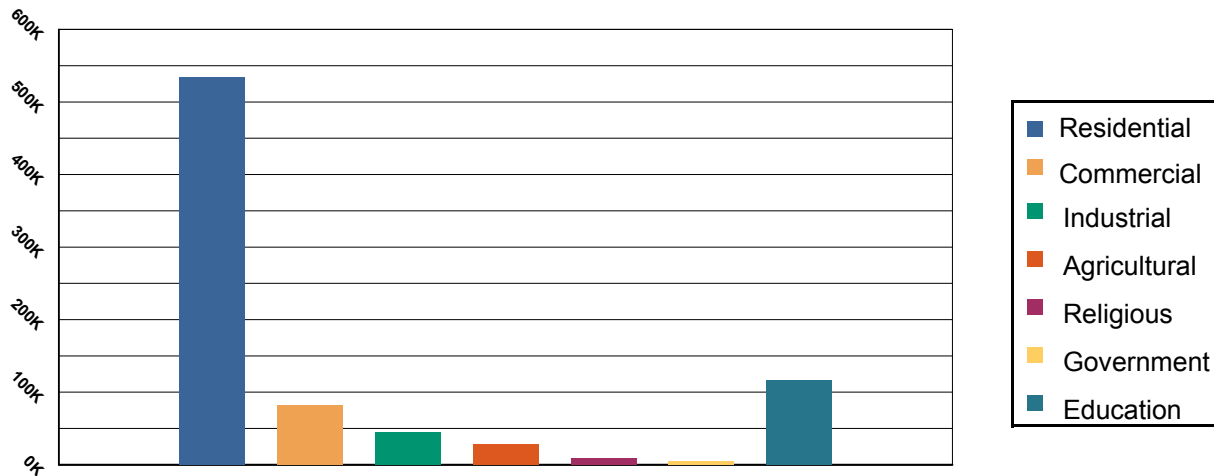


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Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## Hurricane Scenario

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

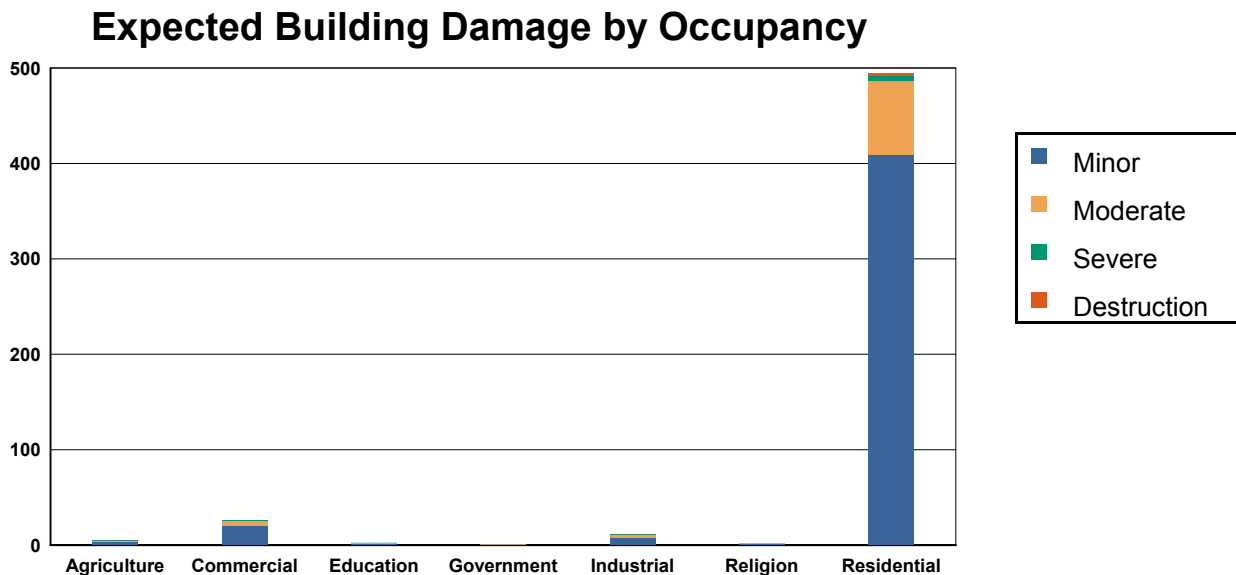
**Scenario Name:** Probabilistic

**Type:** Probabilistic

## Building Damage

### General Building Stock Damage

Hazus estimates that about 98 buildings will be at least moderately damaged. This is over 5% 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 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	13.92	73.25	3.51	18.46	1.02	5.36	0.49	2.59	0.06	0.34
Commercial	91.39	77.45	19.90	16.86	5.93	5.03	0.77	0.65	0.00	0.00
Education	8.45	76.83	1.93	17.53	0.57	5.21	0.05	0.42	0.00	0.00
Government	3.11	77.85	0.67	16.77	0.20	5.01	0.02	0.38	0.00	0.00
Industrial	39.71	77.86	8.01	15.70	2.62	5.14	0.61	1.20	0.06	0.11
Religion	6.29	78.64	1.41	17.66	0.28	3.49	0.02	0.21	0.00	0.00
Residential	1,291.81	72.33	408.64	22.88	77.93	4.36	5.12	0.29	2.50	0.14
<b>Total</b>	<b>1,454.68</b>		<b>444.06</b>		<b>88.56</b>		<b>7.07</b>		<b>2.63</b>	

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

<b>Building Type</b>	<b>None</b>		<b>Minor</b>		<b>Moderate</b>		<b>Severe</b>		<b>Destruction</b>	
	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>
Concrete	10	79.31	2	15.75	1	4.68	0	0.26	0	0.00
Masonry	79	71.01	20	17.88	10	9.39	2	1.53	0	0.19
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	67	79.21	13	14.87	4	5.05	1	0.85	0	0.01
Wood	1,234	72.83	392	23.12	62	3.66	4	0.26	2	0.14



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### **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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Thematic Map of Essential Facilities with greater than 50% moderate**

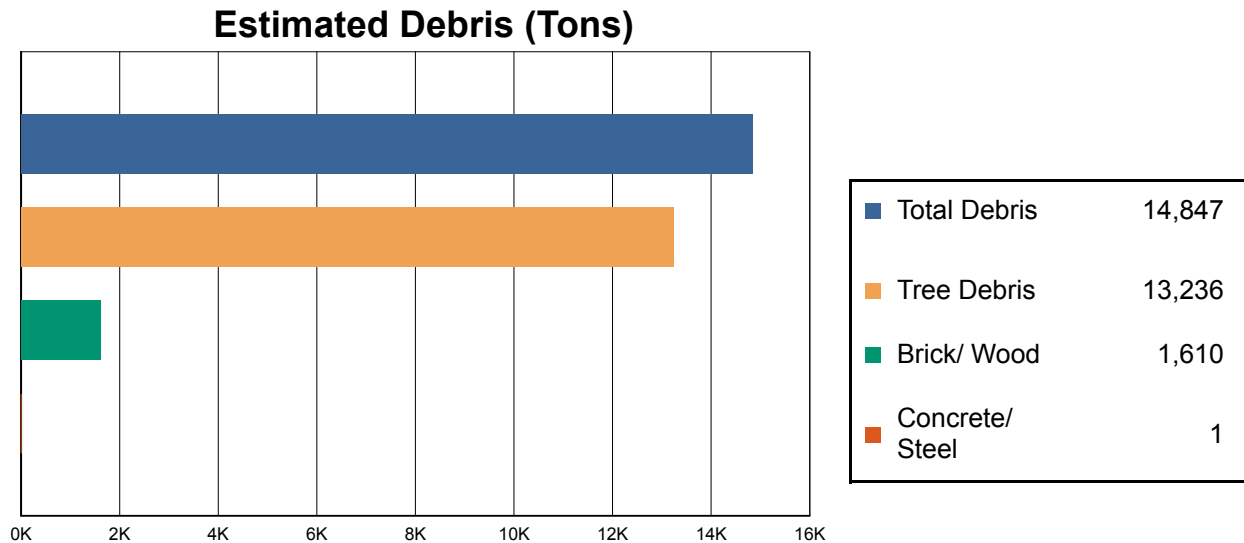


**Table 4: Expected Damage to Essential Facilities**

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
Fire Stations	2	0	0	2
Police Stations	1	0	0	1
Schools	4	0	0	3

## Induced Hurricane Damage

### Debris Generation

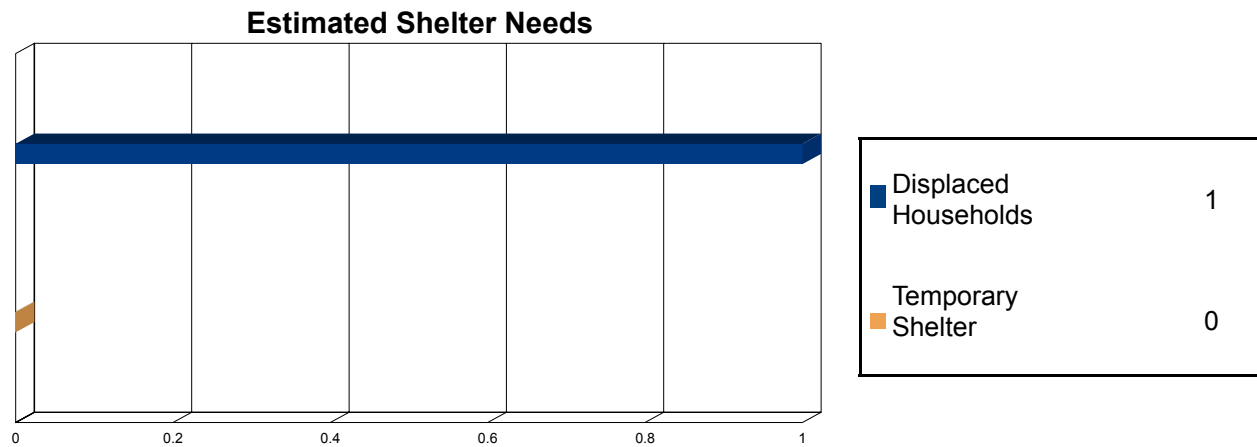


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 14,847 tons of debris will be generated. Of the total amount, 10,828 tons (73%) is Other Tree Debris. Of the remaining 4,019 tons, Brick/Wood comprises 40% 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 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 2,408 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 household to be displaced due to the hurricane. Of these, 0 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

The total economic loss estimated for the hurricane is 21.2 million dollars, which represents 2.59 % of the total replacement value of the region's buildings.

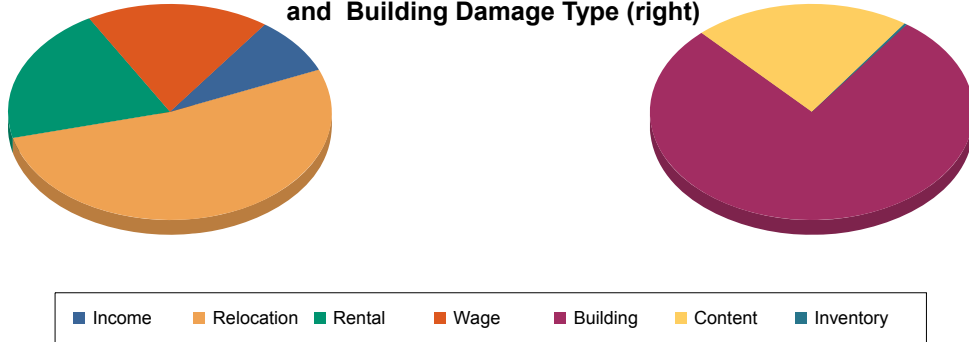
### **Building-Related Losses**

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.

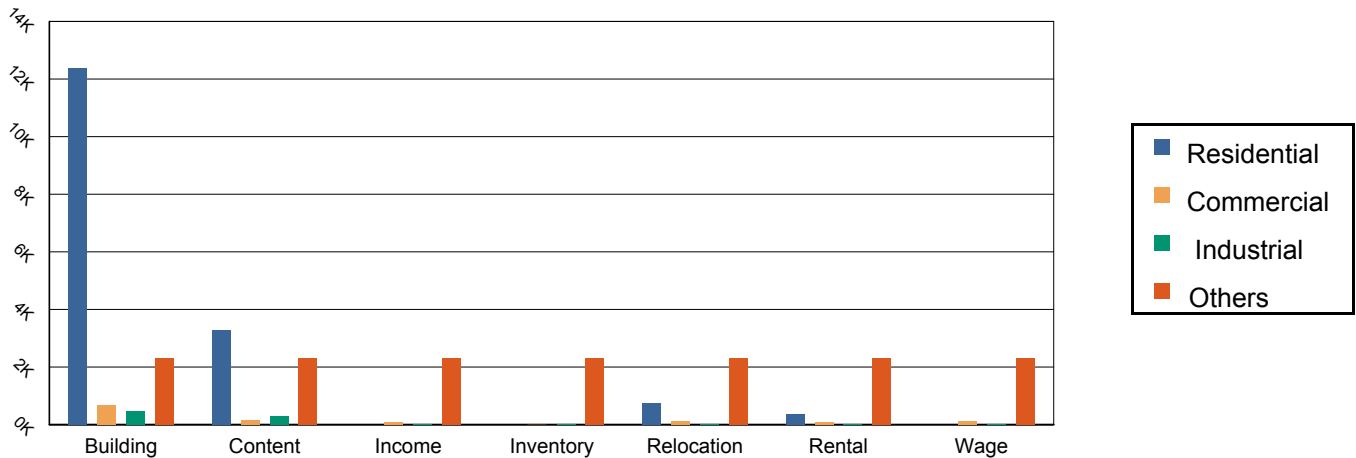
The total property damage losses were 21 million dollars. 10% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 79% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	12,383.51	690.47	477.43	1,323.02	14,874.44
	Content	3,292.32	170.99	297.56	367.87	4,128.75
	Inventory	0.00	3.53	35.92	16.81	56.25
	<b>Subtotal</b>	<b>15,675.83</b>	<b>864.98</b>	<b>810.92</b>	<b>1,707.71</b>	<b>19,059.44</b>
<b>Business Interruption Loss</b>						
	Income	0.00	87.20	5.51	95.44	188.14
	Relocation	743.32	131.90	33.72	226.88	1,135.82
	Rental	349.75	78.52	5.49	12.21	445.97
	Wage	0.00	110.24	9.21	278.82	398.27
	<b>Subtotal</b>	<b>1,093.07</b>	<b>407.86</b>	<b>53.92</b>	<b>613.35</b>	<b>2,168.20</b>



Total

Total	16,768.90	1,272.84	864.84	2,321.06	21,227.64
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



## Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Connecticut</b>				
Middlesex	4,629	534,584	284,620	819,204
<b>Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>
<b>Study Region Total</b>	<b>4,629</b>	<b>534,584</b>	<b>284,620</b>	<b>819,204</b>



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**RiskMAP**  
Increasing Resilience Together

# Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** Probabilistic 1000-year Return Period

**Print Date:** Tuesday, October 1, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

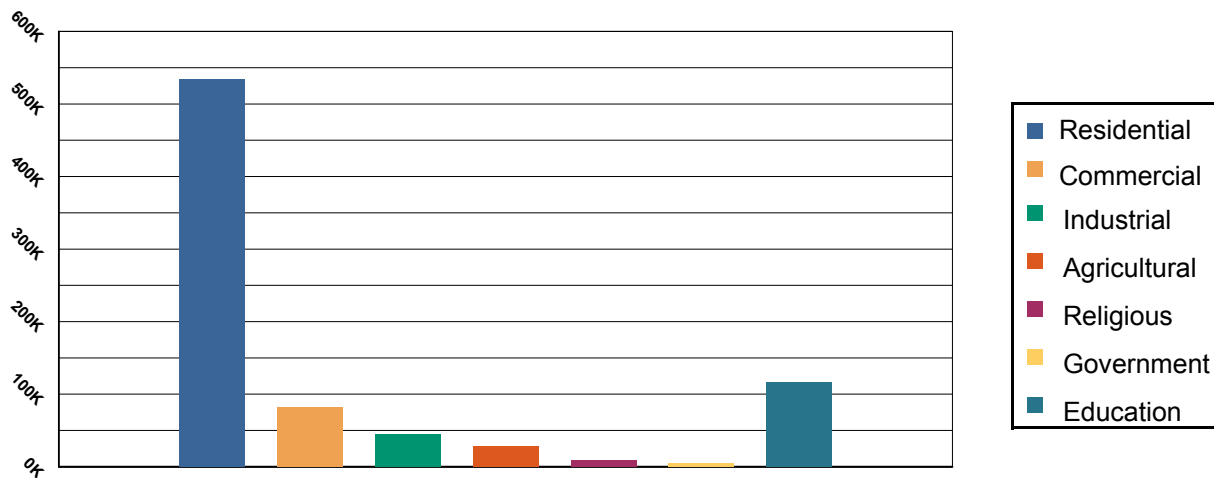


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26 %
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## 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

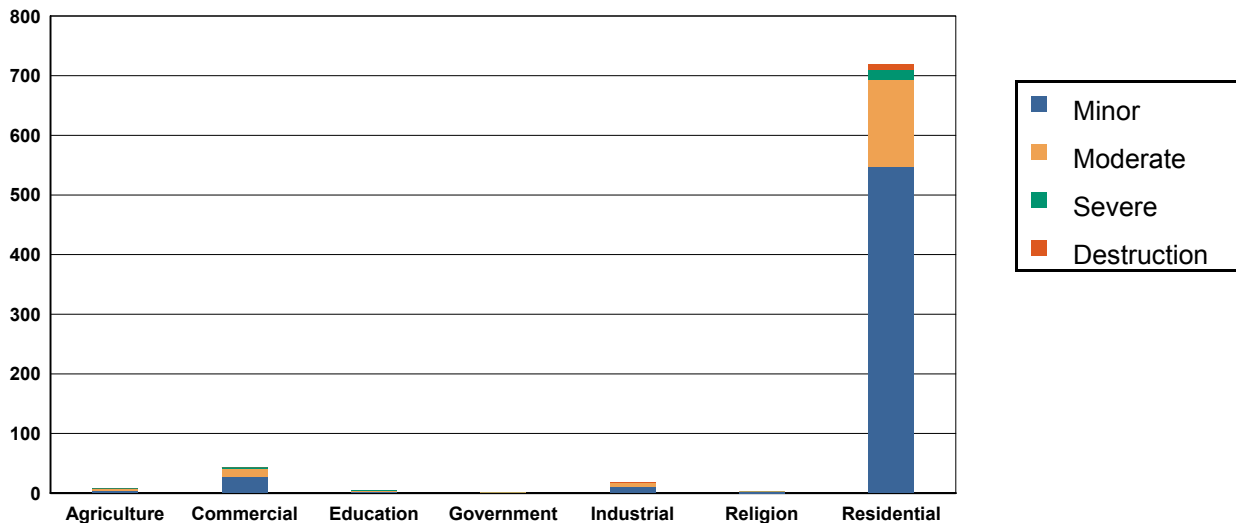
**Type:** Probabilistic

## Building Damage

### General Building Stock Damage

Hazus estimates that about 200 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 10 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

**Expected Building Damage by Occupancy**



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

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	11.32	59.59	4.83	25.44	1.83	9.62	0.88	4.62	0.14	0.73
Commercial	75.27	63.79	27.58	23.37	12.87	10.91	2.27	1.92	0.02	0.01
Education	6.87	62.50	2.62	23.82	1.30	11.78	0.21	1.90	0.00	0.00
Government	2.55	63.65	0.92	22.93	0.46	11.62	0.07	1.80	0.00	0.00
Industrial	32.71	64.15	10.98	21.54	5.69	11.16	1.48	2.91	0.13	0.25
Religion	5.22	65.25	2.02	25.22	0.69	8.58	0.08	0.94	0.00	0.00
Residential	1,066.52	59.72	547.71	30.67	145.50	8.15	16.85	0.94	9.42	0.53
<b>Total</b>	<b>1,200.46</b>		<b>596.66</b>		<b>168.34</b>		<b>21.83</b>		<b>9.71</b>	

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

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	65.46	3	21.76	1	11.37	0	1.41	0	0.00
Masonry	64	58.04	26	23.01	17	15.38	3	3.09	1	0.47
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	56	65.50	17	20.57	10	11.40	2	2.50	0	0.03
Wood	1,018	60.12	530	31.31	122	7.18	15	0.88	9	0.51



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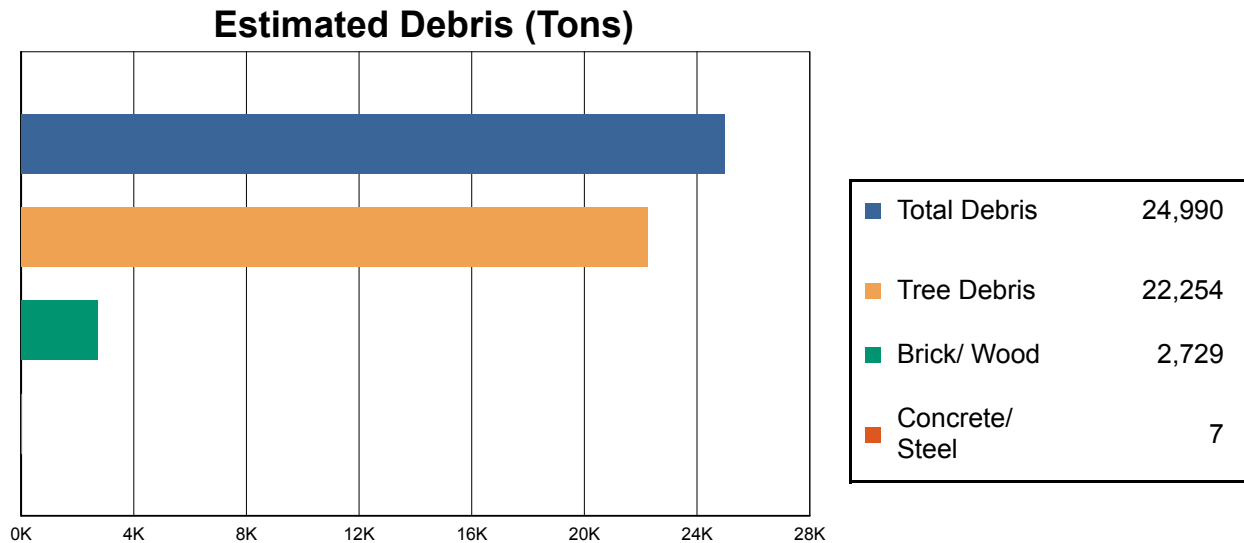
### **Essential Facility Damage**

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

Total	# Facilities		
	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
1	0	0	1
2	0	0	2
1	0	0	1
4	0	0	0

## Induced Hurricane Damage

### Debris Generation

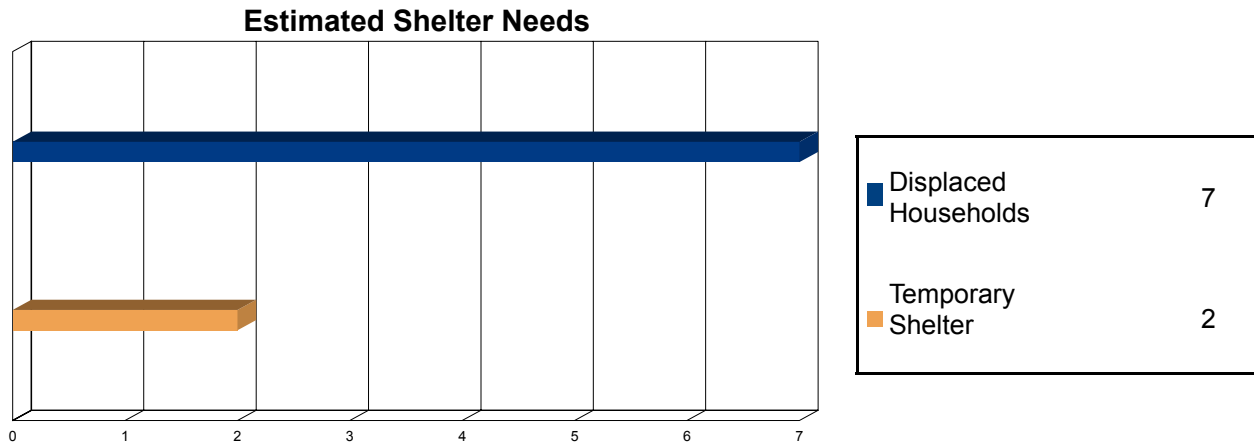


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 24,990 tons of debris will be generated. Of the total amount, 18,205 tons (73%) is Other Tree Debris. Of the remaining 6,785 tons, Brick/Wood comprises 40% 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 109 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 4,049 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, 2 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



## Economic Loss

The total economic loss estimated for the hurricane is 40.1 million dollars, which represents 4.89 % of the total replacement value of the region's buildings.

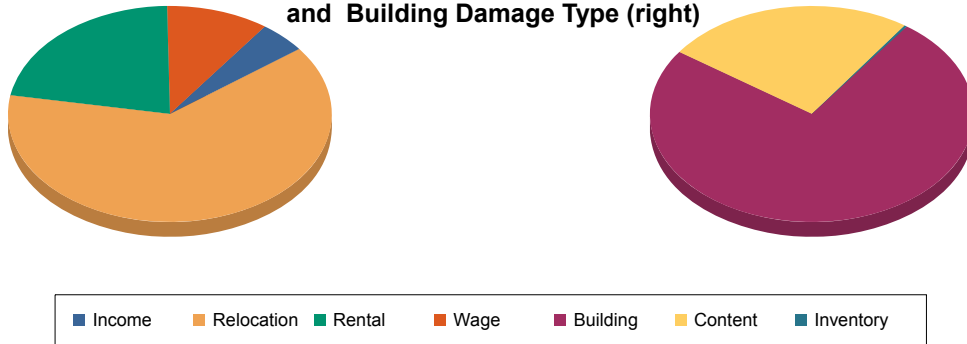
### **Building-Related Losses**

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.

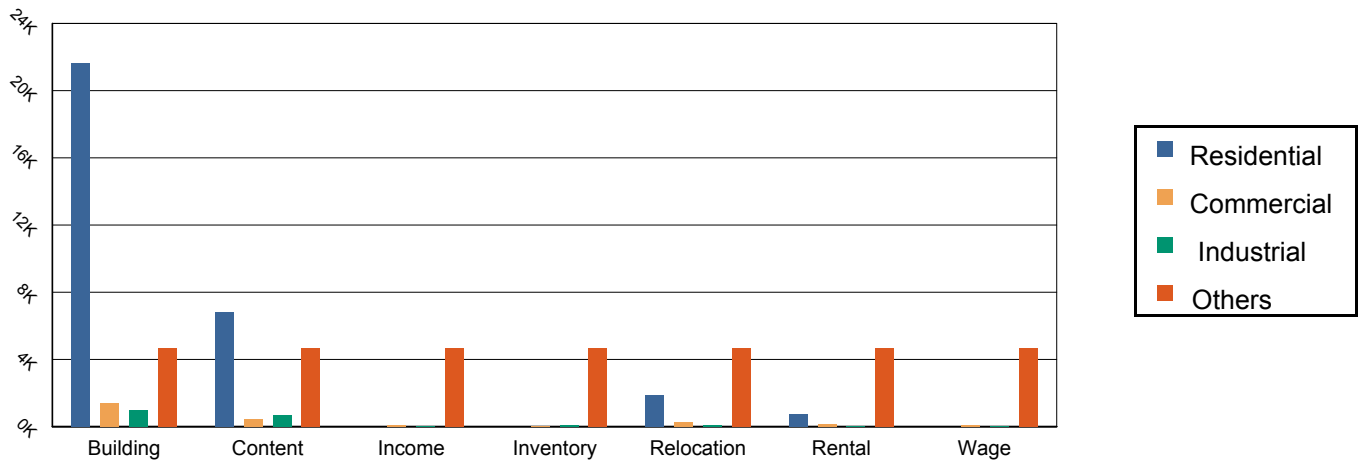
The total property damage losses were 40 million dollars. 11% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 77% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy



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

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	21,603.11	1,402.97	984.42	2,769.62	26,760.13
	Content	6,821.14	470.47	681.84	992.69	8,966.15
	Inventory	0.00	9.25	78.41	33.87	121.53
	<b>Subtotal</b>	<b>28,424.25</b>	<b>1,882.69</b>	<b>1,744.68</b>	<b>3,796.18</b>	<b>35,847.80</b>
<b>Business Interruption Loss</b>						
	Income	0.23	84.90	8.70	103.05	196.88
	Relocation	1,850.60	263.54	73.47	463.52	2,651.13
	Rental	742.62	149.37	10.92	24.30	927.21
	Wage	0.54	113.00	14.54	303.41	431.49
	<b>Subtotal</b>	<b>2,593.99</b>	<b>610.82</b>	<b>107.63</b>	<b>894.28</b>	<b>4,206.72</b>



Total

Total	31,018.24	2,493.50	1,852.31	4,690.46	40,054.52
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	4,629	534,584	284,620	819,204
Total	4,629	534,584	284,620	819,204
Study Region Total	4,629	534,584	284,620	819,204



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## Hazus: Hurricane Global Risk Report

**Region Name:** DeepRiver

**Hurricane Scenario:** UN-NAMED-1938-4

**Print Date:** Monday, October 14, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique.*

*Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 4,629 people (2010 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 819 million dollars (2014 dollars). Approximately 89% of the buildings (and 65% of the building value) are associated with residential housing.

## Building Inventory

### General Building Stock

Hazus estimates that there are 1,997 buildings in the region which have an aggregate total replacement value of 819 million (2014 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.

### Building Exposure by Occupancy Type

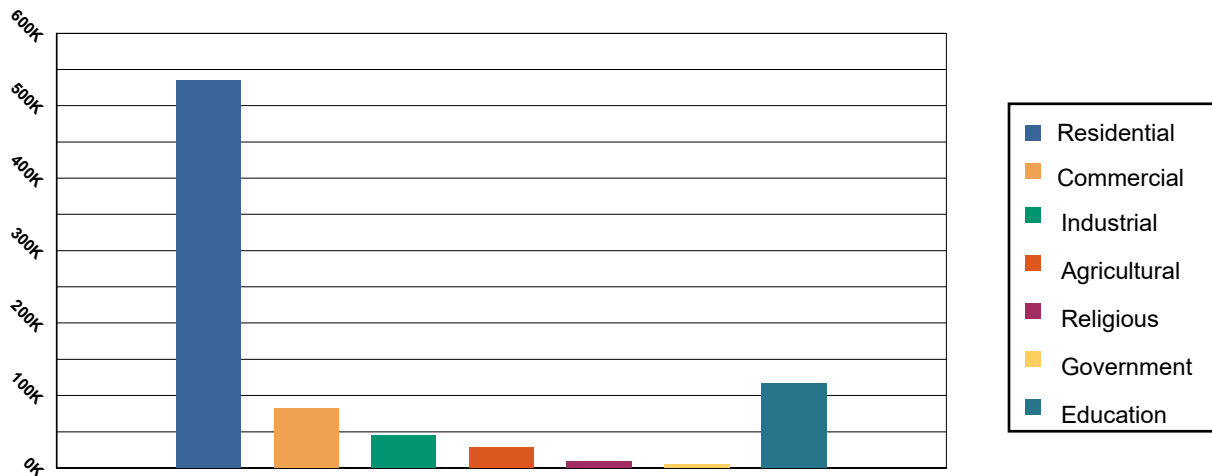


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure (\$1000)	Percent of Tot
Residential	534,584	65.26%
Commercial	82,267	10.04%
Industrial	44,340	5.41%
Agricultural	28,107	3.43%
Religious	8,658	1.06%
Government	4,762	0.58%
Education	116,486	14.22%
<b>Total</b>	<b>819,204</b>	<b>100.00%</b>

### Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities.





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## 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 148 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 6 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

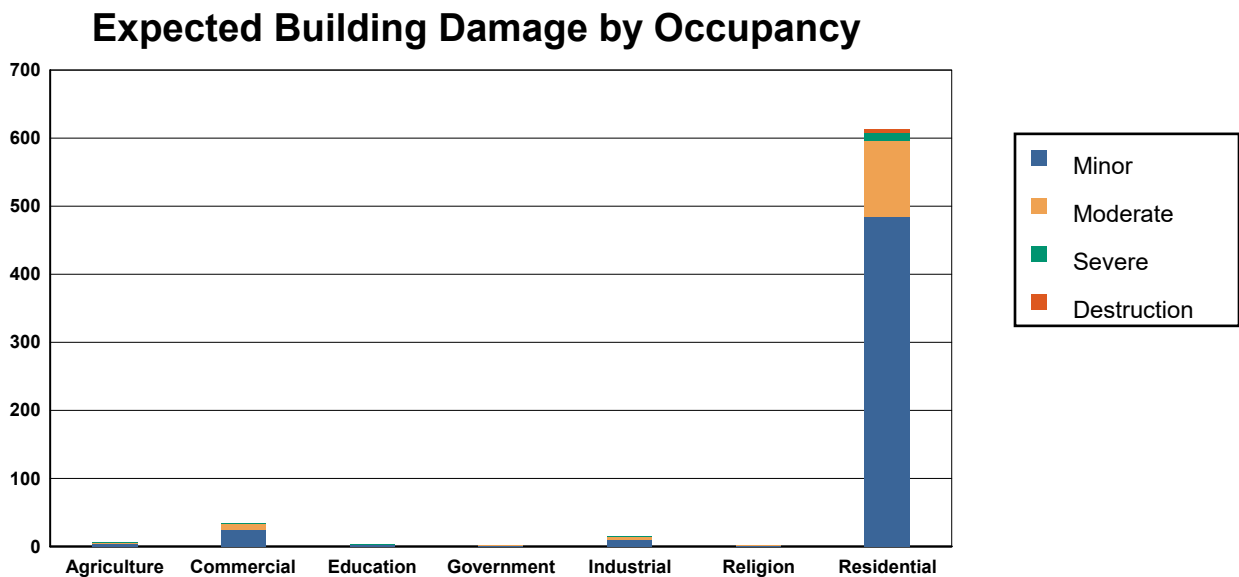


Table 2: Expected Building Damage by Occupancy

Occupancy	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	12.56	66.08	4.23	22.27	1.42	7.50	0.69	3.63	0.10	0.52
Commercial	83.00	70.34	24.15	20.47	9.38	7.95	1.45	1.23	0.01	0.01
Education	7.63	69.35	2.32	21.06	0.94	8.51	0.12	1.07	0.00	0.00
Government	2.82	70.46	0.81	20.24	0.33	8.31	0.04	1.00	0.00	0.00
Industrial	36.07	70.73	9.66	18.95	4.15	8.14	1.02	2.00	0.09	0.17
Religion	5.73	71.66	1.75	21.82	0.48	6.01	0.04	0.52	0.00	0.00
Residential	1,172.93	65.67	484.89	27.15	112.21	6.28	10.34	0.58	5.62	0.31
<b>Total</b>	<b>1,320.74</b>		<b>527.81</b>		<b>128.92</b>		<b>13.70</b>		<b>5.82</b>	



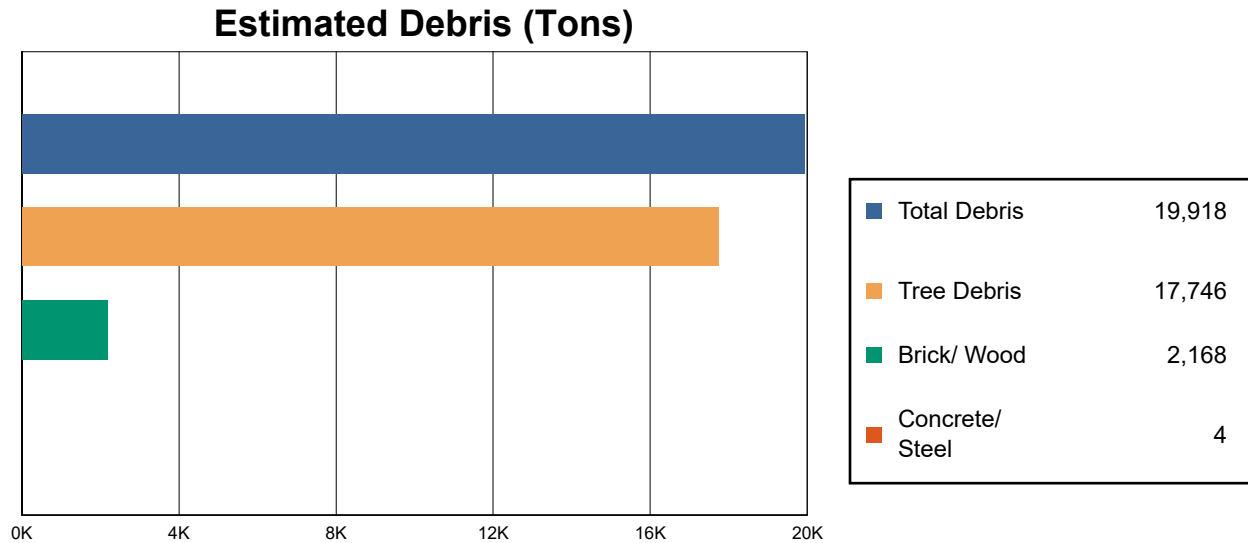
**Table 3: Expected Building Damage by Building Type**

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	72.13	2	19.13	1	7.98	0	0.76	0	0.00
Masonry	71	64.18	23	20.75	14	12.47	3	2.29	0	0.32
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	61	72.11	15	18.06	7	8.21	1	1.61	0	0.02
Wood	1,120	66.13	468	27.60	92	5.43	9	0.54	5	0.30



## Induced Hurricane Damage

### Debris Generation

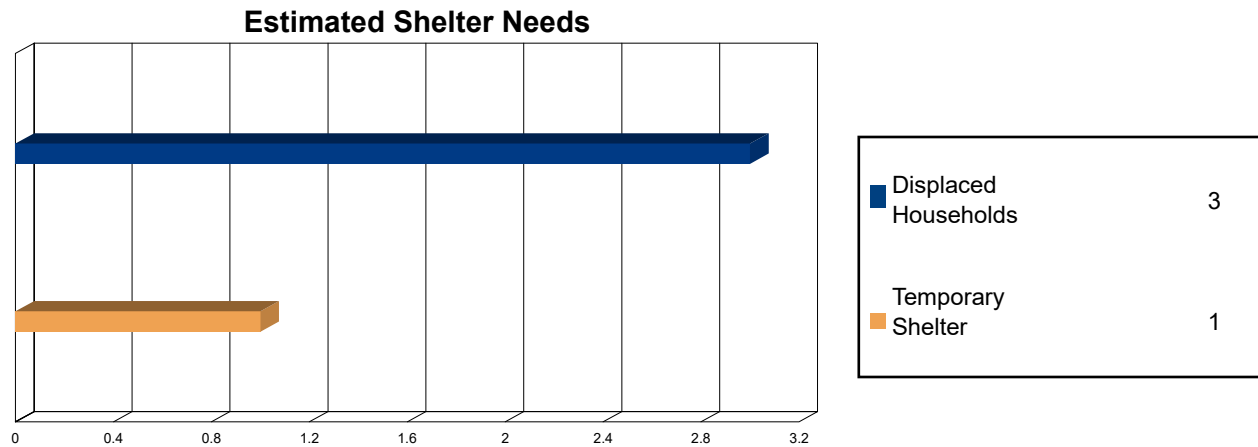


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling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

The model estimates that a total of 19,918 tons of debris will be generated. Of the total amount, 14,517 tons (73%) is Other Tree Debris. Of the remaining 5,401 tons, Brick/Wood comprises 40% 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 87 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 3,229 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, 1 people (out of a total population of 4,629) will seek temporary shelter in public shelters.



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## Economic Loss

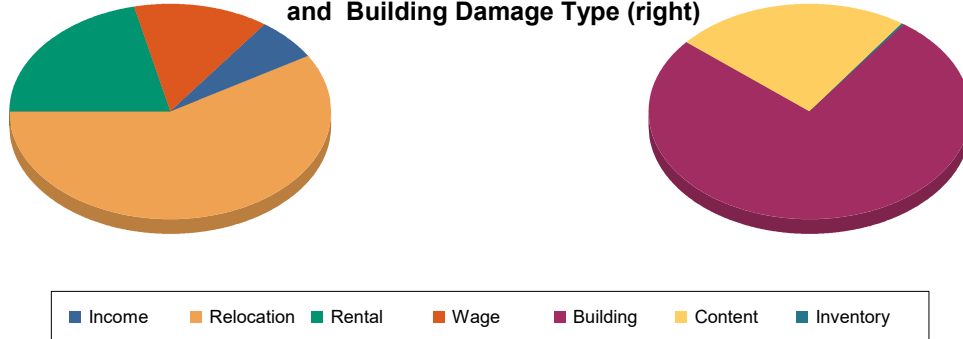
The total economic loss estimated for the hurricane is 30.3 million dollars, which represents 3.69 % of the total replacement value of the region's buildings.

### **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 30 million dollars. 10% 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 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left)  
and Building Damage Type (right)



Loss Type by General Occupancy

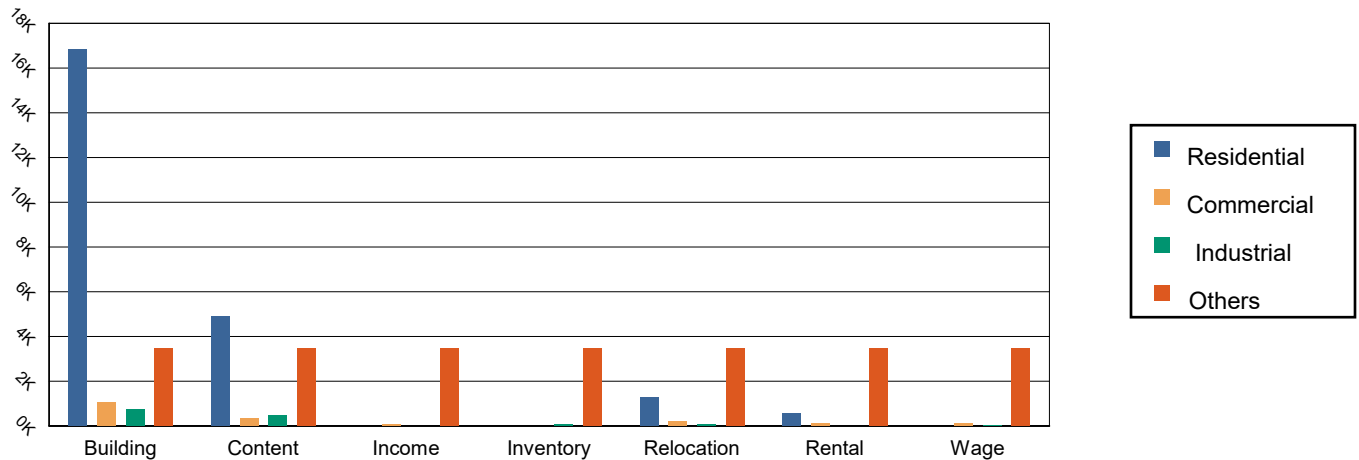


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Property Damage</b>						
	Building	16,845.16	1,038.57	726.55	2,029.78	20,640.05
	Content	4,913.22	315.71	482.89	678.19	6,390.02
	Inventory	0.00	6.27	56.54	25.20	88.02
	<b>Subtotal</b>	<b>21,758.38</b>	<b>1,360.54</b>	<b>1,265.99</b>	<b>2,733.17</b>	<b>27,118.08</b>
<b>Business Interruption Loss</b>						
	Income	0.05	91.09	7.05	101.68	199.86
	Relocation	1,267.94	192.35	52.81	335.85	1,848.96
	Rental	538.33	110.02	8.06	17.41	673.82
	Wage	0.11	118.52	11.80	298.10	428.53
	<b>Subtotal</b>	<b>1,806.42</b>	<b>511.99</b>	<b>79.72</b>	<b>753.04</b>	<b>3,151.17</b>





Total

Total	23,564.80	1,872.53	1,345.71	3,486.21	30,269.25
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## **Appendix A: County Listing for the Region**

Connecticut  
- Middlesex



**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
Connecticut				
Middlesex	4,629	534,584	284,620	819,204
Total	4,629	534,584	284,620	819,204
Study Region Total	4,629	534,584	284,620	819,204



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## Hazus: Earthquake Global Risk Report

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**Region Name:** DeepRiver

**Earthquake Scenario:** EastHaddam

**Print Date:** October 16, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) 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 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 819 (millions of dollars). Approximately 89.00 % 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 440 and 8 (millions of dollars), respectively.

## **Building and Lifeline Inventory**

### **Building Inventory**

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 819 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region 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 beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no 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 448.00 (millions of dollars). This inventory includes over 31.07 miles of highways, 15 bridges, 265.33 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	90.1624
	Segments	12	334.7592
	Tunnels	0	0.0000
	Subtotal		<b>424.9216</b>
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	2	13.2639
	Tunnels	0	0.0000
	Subtotal		<b>13.2639</b>
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
Bus	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Ferry	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Port	Facilities	1	1.9970
	Subtotal		<b>1.9970</b>
Airport	Facilities	0	0.0000
	Runways	0	0.0000
	Subtotal		<b>0.0000</b>
		Total	<b>440.20</b>

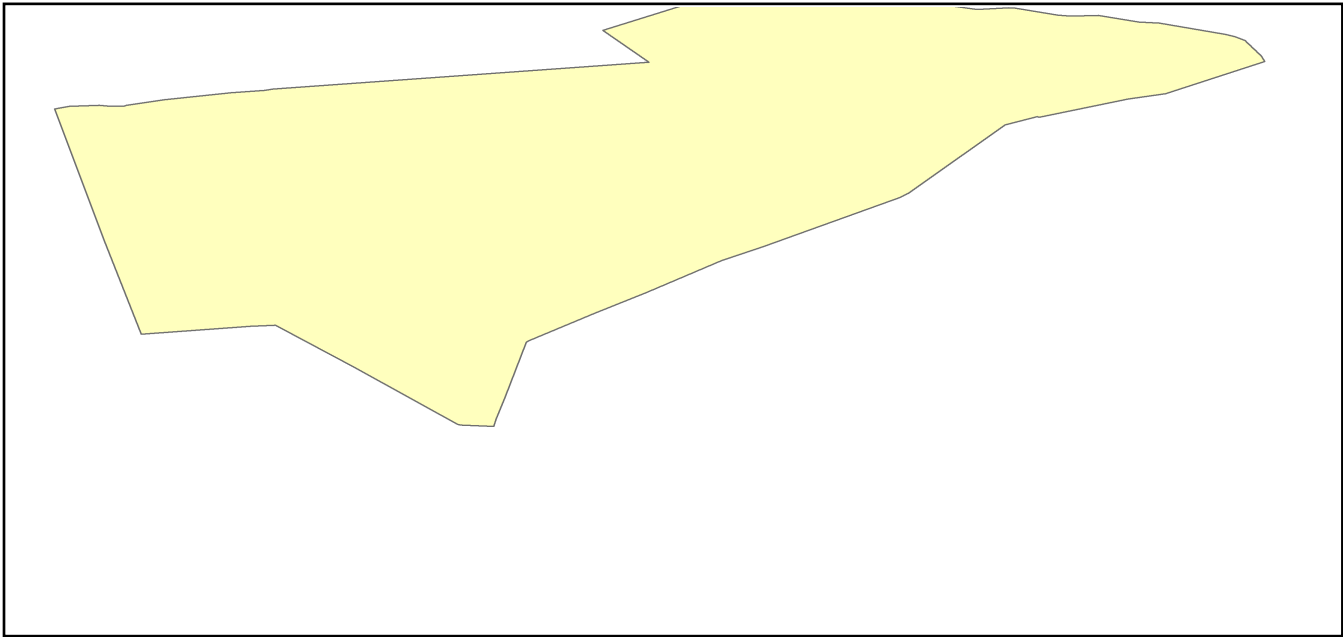


**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Potable Water</b>	Distribution Lines	NA	4.2787
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>4.2787</b>
<b>Waste Water</b>	Distribution Lines	NA	2.5672
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>2.5672</b>
<b>Natural Gas</b>	Distribution Lines	NA	1.7115
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>1.7115</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Communication</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
		<b>Total</b>	<b>8.60</b>

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	EastHaddam
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.40
Latitude of Epicenter	41.50
Earthquake Magnitude	6.40
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 833 buildings will be at least moderately damaged. This is over 42.00 % of the buildings in the region. There are an estimated 179 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.

### Damage Categories by General Occupancy Type

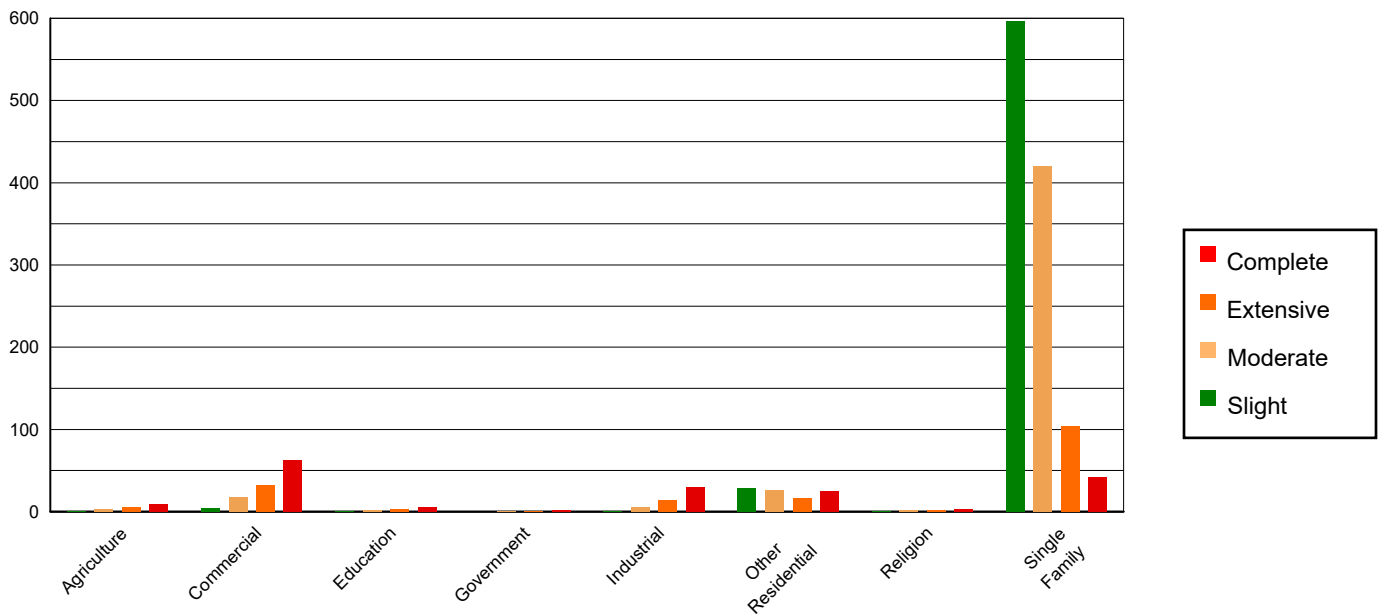


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0.19	0.04	0.71	0.11	3.64	0.77	5.57	3.13	8.90	4.94
Commercial	1.29	0.24	3.78	0.60	17.39	3.65	32.39	18.20	63.16	35.09
Education	0.12	0.02	0.33	0.05	1.51	0.32	3.09	1.74	5.95	3.30
Government	0.04	0.01	0.09	0.01	0.45	0.09	1.07	0.60	2.36	1.31
Industrial	0.45	0.08	1.18	0.19	5.84	1.23	13.51	7.59	30.02	16.68
Other Residential	23.93	4.52	29.37	4.64	25.94	5.45	16.47	9.25	25.28	14.04
Religion	0.99	0.19	1.27	0.20	1.45	0.31	1.47	0.83	2.82	1.56
Single Family	502.93	94.90	596.42	94.20	419.73	88.19	104.40	58.66	41.53	23.07
<b>Total</b>	<b>530</b>		<b>633</b>		<b>476</b>		<b>178</b>		<b>180</b>	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	525.61	99.19	622.30	98.29	438.61	92.16	106.25	59.70	21.29	11.83
<b>Steel</b>	0.45	0.08	0.95	0.15	7.12	1.50	25.17	14.14	62.61	34.78
<b>Concrete</b>	0.08	0.02	0.19	0.03	1.43	0.30	4.67	2.62	11.43	6.35
<b>Precast</b>	0.04	0.01	0.07	0.01	0.51	0.11	1.33	0.75	4.40	2.45
<b>RM</b>	0.44	0.08	0.59	0.09	3.60	0.76	7.83	4.40	14.98	8.32
<b>URM</b>	3.31	0.63	9.04	1.43	24.68	5.19	32.73	18.39	65.29	36.27
<b>MH</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>530</b>		<b>633</b>		<b>476</b>		<b>178</b>		<b>180</b>	

\*Note:

RM      Reinforced Masonry  
 URM     Unreinforced Masonry  
 MH      Manufactured Housing

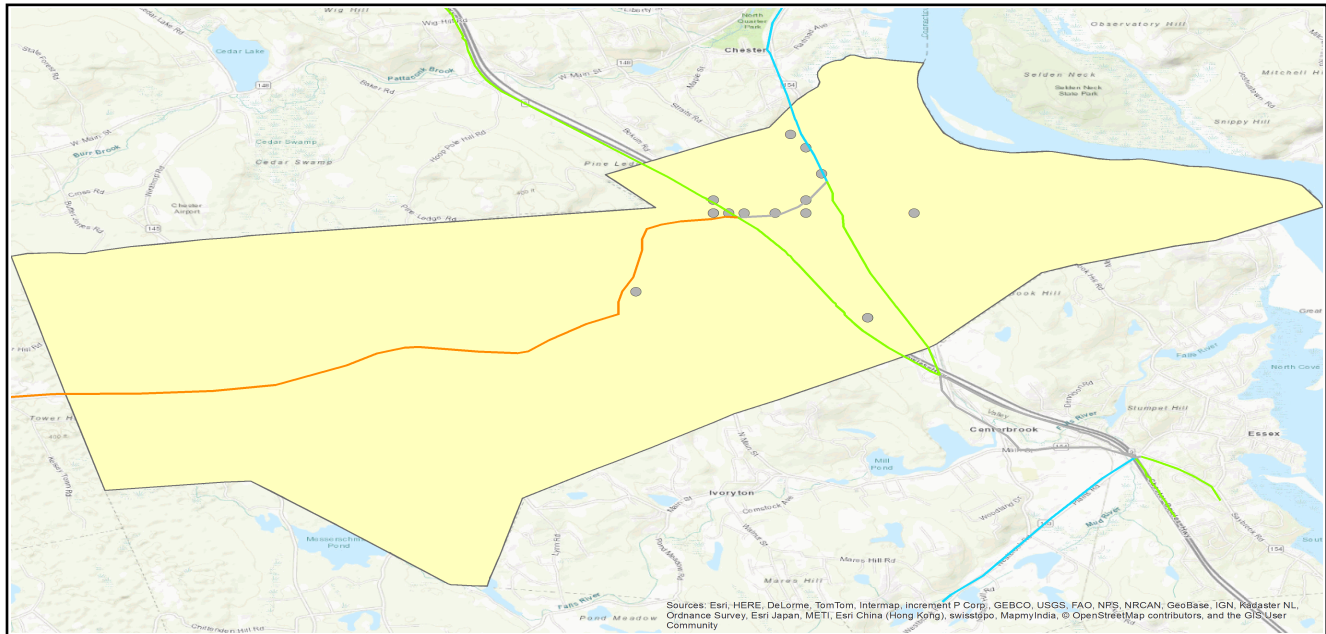
## Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	4	4	4	0
EOCs	1	1	1	0
PoliceStations	1	1	1	0
FireStations	2	2	2	0

## Transportation Lifeline Damage



**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	7	7
	Bridges	15	7	6	8	9
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	1	1
	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	1	1	0	0	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

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 (miles)	Number of Leaks	Number of Breaks
Potable Water	133	0	0
Waste Water	80	0	0
Natural Gas	53	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						
Electric Power						



# Induced Earthquake Damage

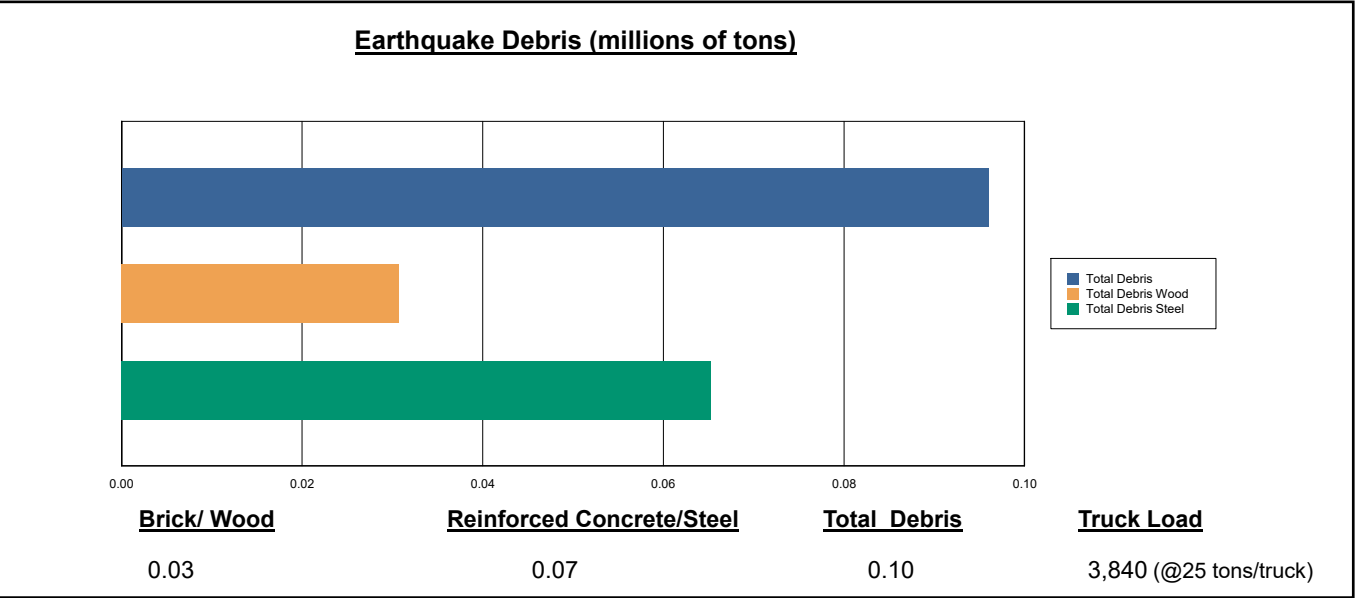
## Fire Following Earthquake

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.

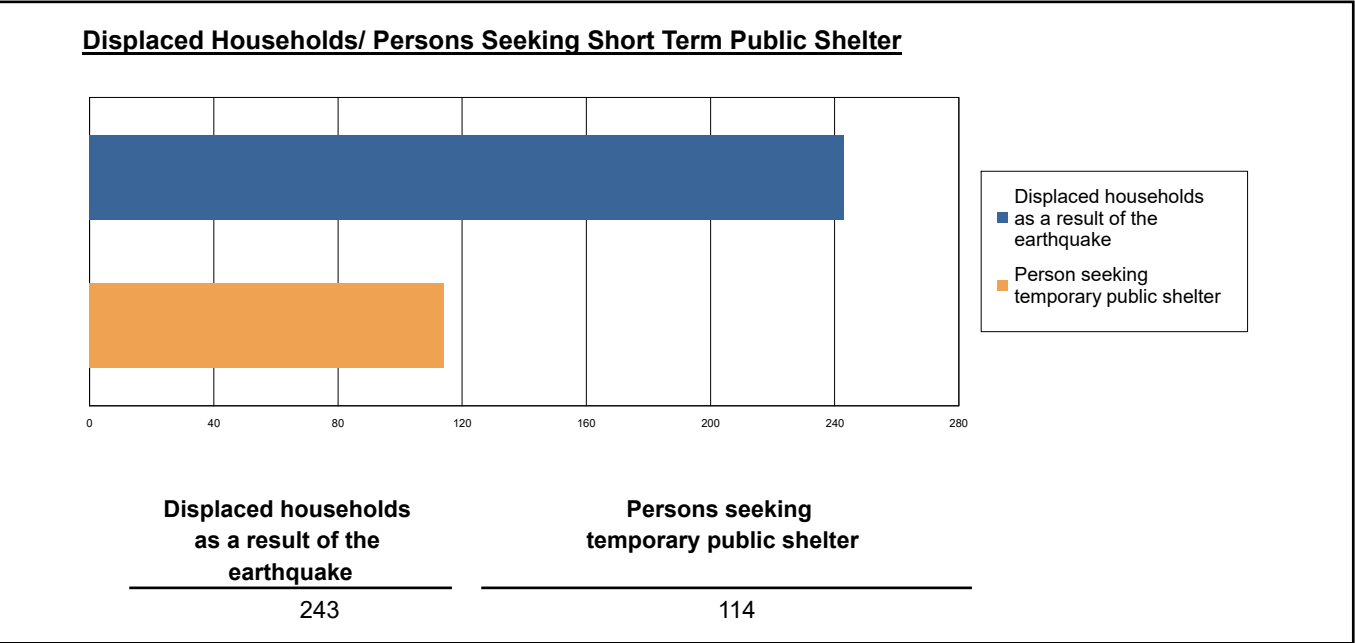
The model estimates that a total of 96,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 32.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 3,840 truckloads (@25 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 243 households to be displaced due to the earthquake. Of these, 114 people (out of a total population of 4,629) 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	2.53	0.76	0.12	0.23
	Commuting	0.01	0.02	0.03	0.01
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	3.69	1.15	0.18	0.36
	Other-Residential	20.27	6.36	1.06	2.10
	Single Family	17.69	4.34	0.59	1.15
	<b>Total</b>	<b>44</b>	<b>13</b>	<b>2</b>	<b>4</b>
2 PM	Commercial	141.94	42.93	6.57	12.84
	Commuting	0.11	0.15	0.25	0.05
	Educational	37.06	11.71	1.95	3.80
	Hotels	0.00	0.00	0.00	0.00
	Industrial	27.36	8.54	1.36	2.65
	Other-Residential	3.81	1.21	0.21	0.39
	Single Family	3.34	0.85	0.12	0.22
	<b>Total</b>	<b>214</b>	<b>65</b>	<b>10</b>	<b>20</b>
5 PM	Commercial	101.47	30.73	4.77	9.13
	Commuting	2.43	3.44	5.57	1.09
	Educational	4.05	1.28	0.21	0.42
	Hotels	0.00	0.00	0.00	0.00
	Industrial	17.10	5.34	0.85	1.65
	Other-Residential	8.07	2.55	0.43	0.83
	Single Family	7.08	1.79	0.26	0.47
	<b>Total</b>	<b>140</b>	<b>45</b>	<b>12</b>	<b>14</b>

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## Economic Loss

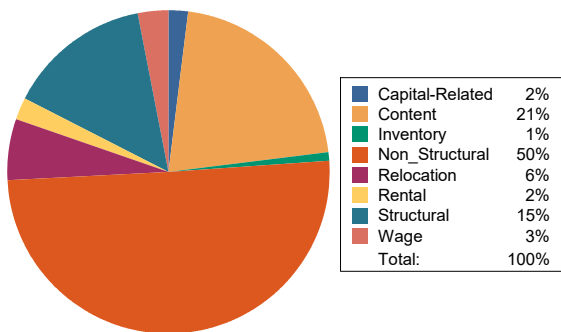
The total economic loss estimated for the earthquake is 412.18 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

## 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 372.27 (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 28 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

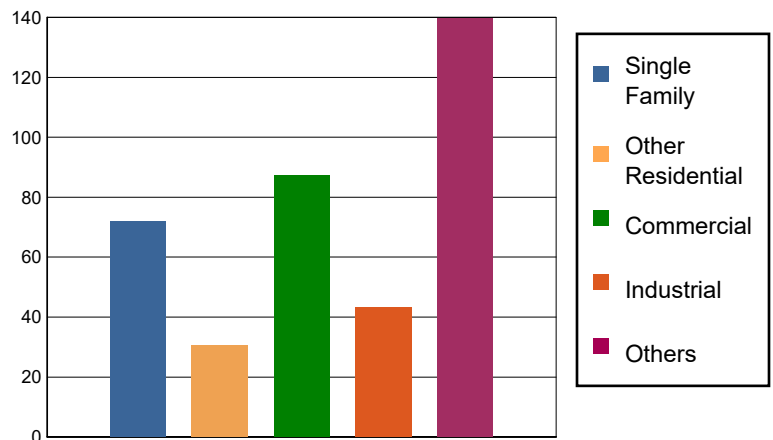


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.9256	7.2753	0.6128	2.3725	11.1862
	Capital-Related	0.0000	0.3924	5.7163	0.3610	1.0447	7.5144
	Rental	1.3486	2.0008	3.8027	0.2187	0.6956	8.0664
	Relocation	4.7796	1.1851	5.3433	0.9963	10.2193	22.5236
	<b>Subtotal</b>	<b>6.1282</b>	<b>4.5039</b>	<b>22.1376</b>	<b>2.1888</b>	<b>14.3321</b>	<b>49.2906</b>
<b>Capital Stock Losses</b>							
	Structural	9.5594	3.2884	11.2235	5.1016	24.9799	54.1528
	Non_Structural	42.2696	18.4358	36.9568	20.8066	69.1656	187.6344
	Content	14.0246	4.1740	16.5092	13.2670	30.4663	78.4411
	Inventory	0.0000	0.0000	0.3373	1.7601	0.6499	2.7473
	<b>Subtotal</b>	<b>65.8536</b>	<b>25.8982</b>	<b>65.0268</b>	<b>40.9353</b>	<b>125.2617</b>	<b>322.9756</b>
	<b>Total</b>	<b>71.98</b>	<b>30.40</b>	<b>87.16</b>	<b>43.12</b>	<b>139.59</b>	<b>372.27</b>

## 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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	334.7592	0.0000	0.00
	Bridges	90.1624	38.6434	42.86
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>424.9216</b>	<b>38.6434</b>	
Railways	Segments	13.2639	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>13.2639</b>	<b>0.0000</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	1.9970	1.2716	63.68
	Subtotal	<b>1.9970</b>	<b>1.2716</b>	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	<b>Total</b>	<b>440.18</b>	<b>39.92</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.2787	0.0000	0.00
	Subtotal	<b>4.2787</b>	<b>0.0000</b>	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.5672	0.0000	0.00
	Subtotal	<b>2.5672</b>	<b>0.0000</b>	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.7115	0.0000	0.00
	Subtotal	<b>1.7115</b>	<b>0.0000</b>	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	Total	<b>8.56</b>	<b>0.00</b>	



FEMA

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## **Appendix A: County Listing for the Region**

Middlesex, CT



**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	Middlesex	4,629	534	284	819
Total Region		4,629	534	284	819



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## Hazus: Earthquake Global Risk Report

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**Region Name:** DeepRiver

**Earthquake Scenario:** Haddam

**Print Date:** October 16, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) 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 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 819 (millions of dollars). Approximately 89.00 % 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 440 and 8 (millions of dollars), respectively.

## **Building and Lifeline Inventory**

### **Building Inventory**

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 819 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region 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 beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no 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 448.00 (millions of dollars). This inventory includes over 31.07 miles of highways, 15 bridges, 265.33 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

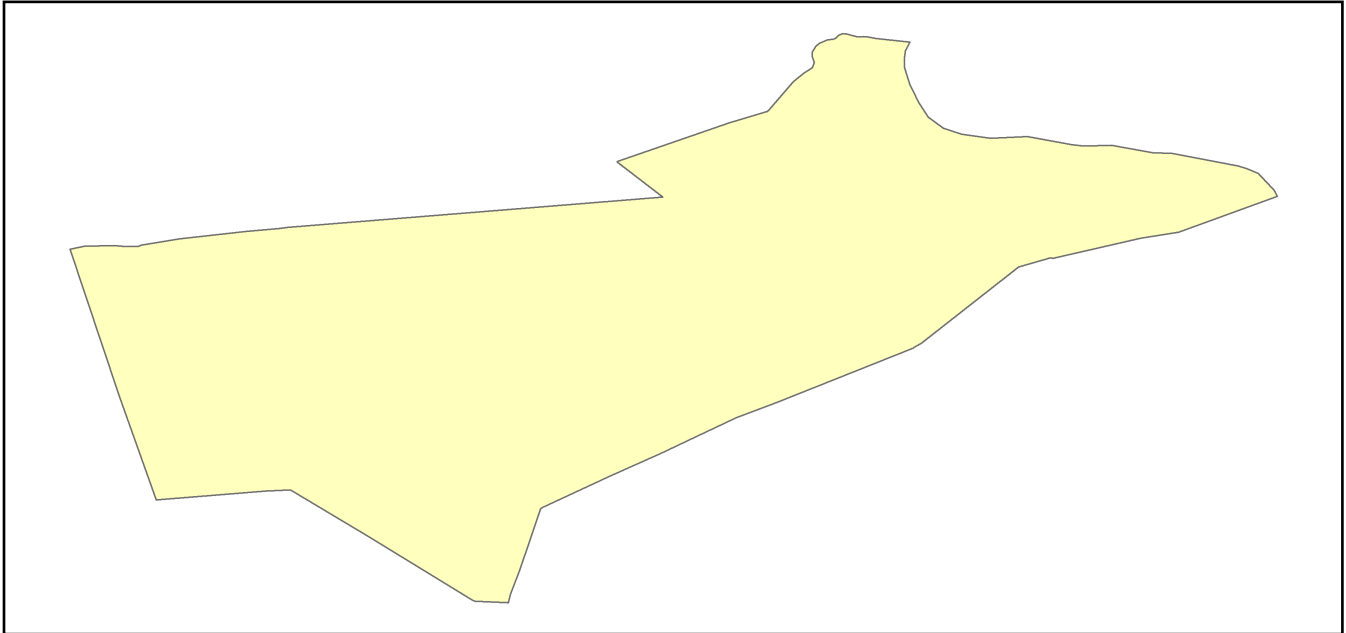
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
<b>Highway</b>	Bridges	15	90.1624
	Segments	12	334.7592
	Tunnels	0	0.0000
	Subtotal		<b>424.9216</b>
<b>Railways</b>	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	2	13.2639
	Tunnels	0	0.0000
	Subtotal		<b>13.2639</b>
<b>Light Rail</b>	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Bus</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Ferry</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Port</b>	Facilities	1	1.9970
	Subtotal		<b>1.9970</b>
<b>Airport</b>	Facilities	0	0.0000
	Runways	0	0.0000
	Subtotal		<b>0.0000</b>
		<b>Total</b>	<b>440.20</b>

**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Potable Water</b>	Distribution Lines	NA	4.2787
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>4.2787</b>
<b>Waste Water</b>	Distribution Lines	NA	2.5672
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>2.5672</b>
<b>Natural Gas</b>	Distribution Lines	NA	1.7115
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>1.7115</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Communication</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
	Total		<b>8.60</b>

## Earthquake Scenario

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



<b>Scenario Name</b>	Haddam
<b>Type of Earthquake</b>	Arbitrary
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	NA
<b>Longitude of Epicenter</b>	-72.50
<b>Latitude of Epicenter</b>	41.50
<b>Earthquake Magnitude</b>	5.70
<b>Depth (km)</b>	10.00
<b>Rupture Length (Km)</b>	NA
<b>Rupture Orientation (degrees)</b>	NA
<b>Attenuation Function</b>	Central & East US (CEUS 2008)



## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 562 buildings will be at least moderately damaged. This is over 28.00 % of the buildings in the region. There are an estimated 65 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.

### Damage Categories by General Occupancy Type

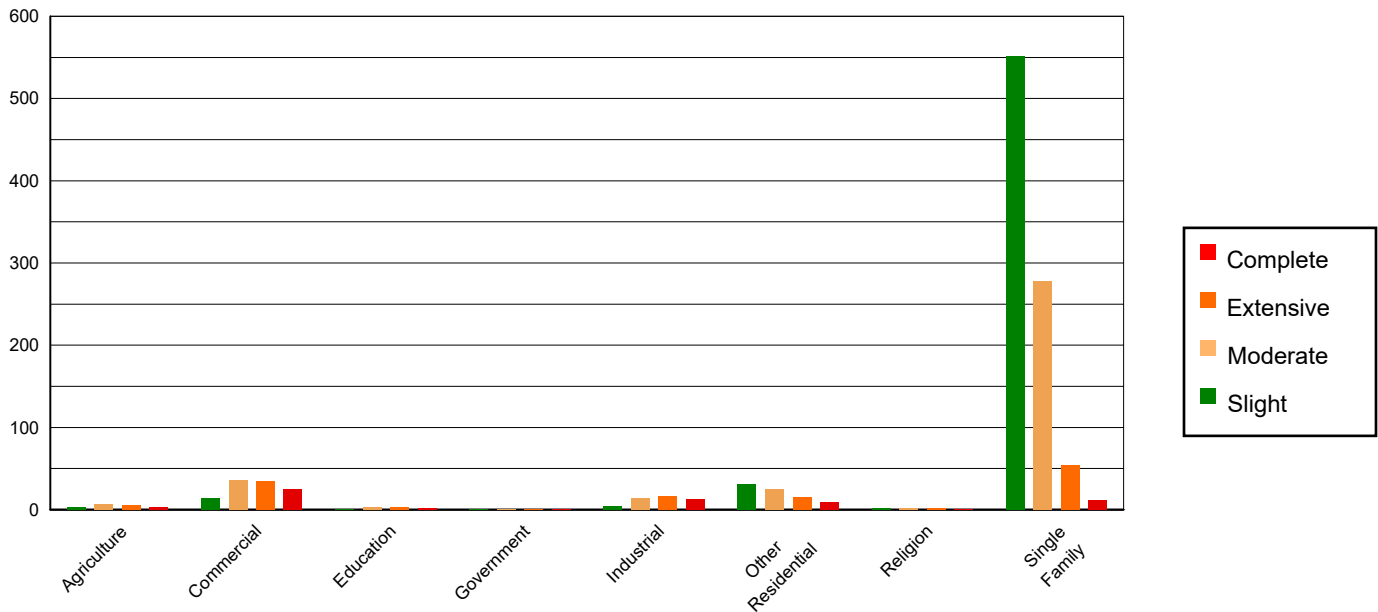


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1.34	0.16	2.70	0.44	6.56	1.80	4.97	3.77	3.43	5.22
Commercial	8.97	1.09	14.29	2.35	35.40	9.69	34.51	26.19	24.83	37.80
Education	0.85	0.10	1.27	0.21	3.24	0.89	3.34	2.54	2.30	3.49
Government	0.25	0.03	0.38	0.06	1.09	0.30	1.30	0.98	0.99	1.50
Industrial	3.26	0.40	4.88	0.80	13.88	3.80	16.33	12.39	12.65	19.26
Other Residential	40.32	4.88	31.44	5.17	25.33	6.93	15.28	11.60	8.63	13.14
Religion	1.92	0.23	1.66	0.27	1.89	0.52	1.54	1.17	0.99	1.50
Single Family	768.88	93.11	551.75	90.69	278.00	76.08	54.50	41.36	11.88	18.08
Total	826		608		365		132		66	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	797.83	96.61	572.19	94.05	288.13	78.86	49.79	37.78	6.13	9.34
<b>Steel</b>	4.01	0.49	5.98	0.98	23.58	6.45	34.08	25.87	28.65	43.61
<b>Concrete</b>	0.69	0.08	1.05	0.17	4.46	1.22	6.55	4.97	5.05	7.69
<b>Precast</b>	0.26	0.03	0.31	0.05	1.34	0.37	2.28	1.73	2.16	3.29
<b>RM</b>	2.29	0.28	2.06	0.34	7.31	2.00	10.14	7.70	5.63	8.57
<b>URM</b>	20.73	2.51	26.78	4.40	40.57	11.10	28.92	21.95	18.06	27.49
<b>MH</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>826</b>		<b>608</b>		<b>365</b>		<b>132</b>		<b>66</b>	

\*Note:

RM      Reinforced Masonry  
 URM     Unreinforced Masonry  
 MH      Manufactured Housing

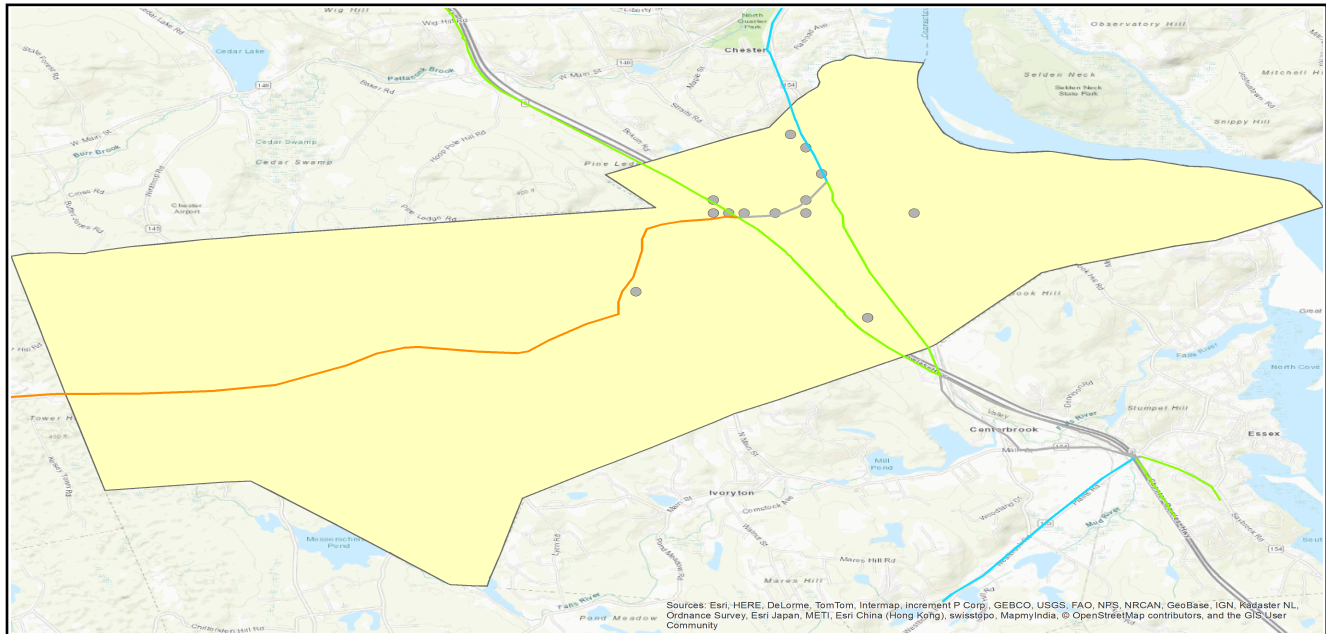
### **Essential Facility Damage**

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	4	4	0	0
EOCs	1	1	0	0
PoliceStations	1	1	0	0
FireStations	2	2	0	0

## Transportation Lifeline Damage



**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	7	7
	Bridges	15	6	0	9	9
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	1	1
	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	1	1	0	1	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

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 (miles)	Number of Leaks	Number of Breaks
Potable Water	133	0	0
Waste Water	80	0	0
Natural Gas	53	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						
Electric Power						

# Induced Earthquake Damage

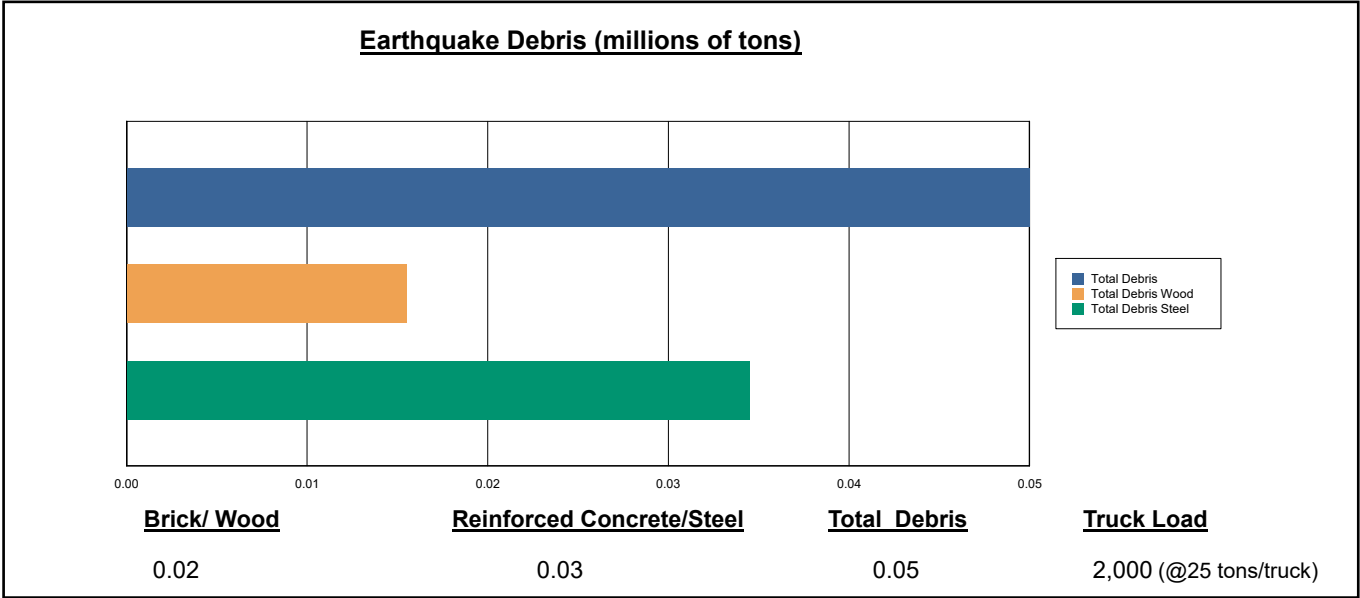
## Fire Following Earthquake

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.

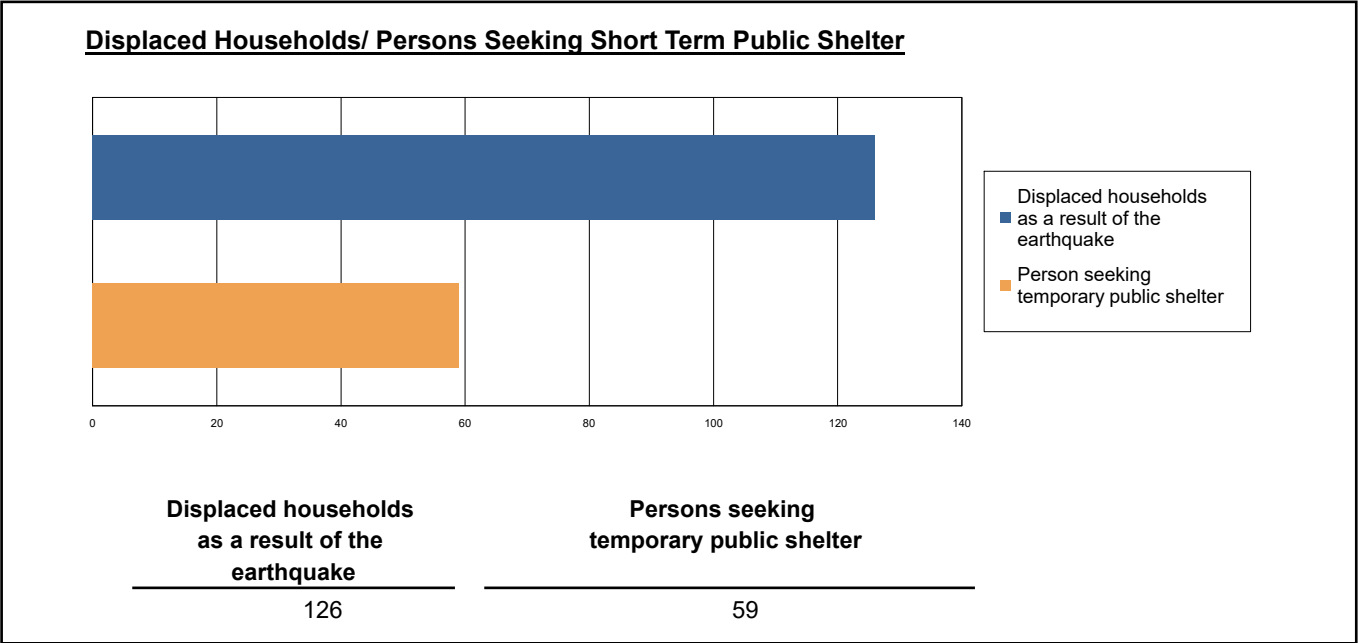
The model estimates that a total of 50,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 31.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 2,000 truckloads (@25 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 126 households to be displaced due to the earthquake. Of these, 59 people (out of a total population of 4,629) 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
<b>2 AM</b>	Commercial	1.08	0.30	0.04	0.08
	Commuting	0.01	0.01	0.01	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	1.69	0.49	0.07	0.14
	Other-Residential	7.75	2.20	0.35	0.70
	Single Family	7.13	1.41	0.16	0.32
	<b>Total</b>	<b>18</b>	<b>4</b>	<b>1</b>	<b>1</b>
<b>2 PM</b>	Commercial	60.55	16.78	2.44	4.75
	Commuting	0.05	0.06	0.11	0.02
	Educational	15.87	4.63	0.75	1.45
	Hotels	0.00	0.00	0.00	0.00
	Industrial	12.49	3.59	0.55	1.06
	Other-Residential	1.45	0.41	0.07	0.13
	Single Family	1.33	0.27	0.03	0.06
	<b>Total</b>	<b>92</b>	<b>26</b>	<b>4</b>	<b>7</b>
<b>5 PM</b>	Commercial	43.11	11.96	1.76	3.36
	Commuting	1.08	1.36	2.40	0.46
	Educational	1.74	0.51	0.08	0.16
	Hotels	0.00	0.00	0.00	0.00
	Industrial	7.81	2.25	0.34	0.66
	Other-Residential	3.07	0.87	0.14	0.27
	Single Family	2.82	0.58	0.07	0.13
	<b>Total</b>	<b>60</b>	<b>18</b>	<b>5</b>	<b>5</b>

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## Economic Loss

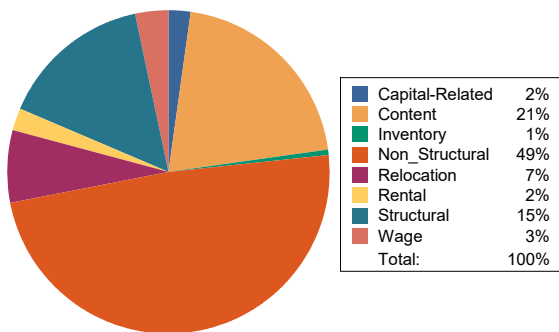
The total economic loss estimated for the earthquake is 221.38 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

## 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 199.00 (millions of dollars); 15 % 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 29 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

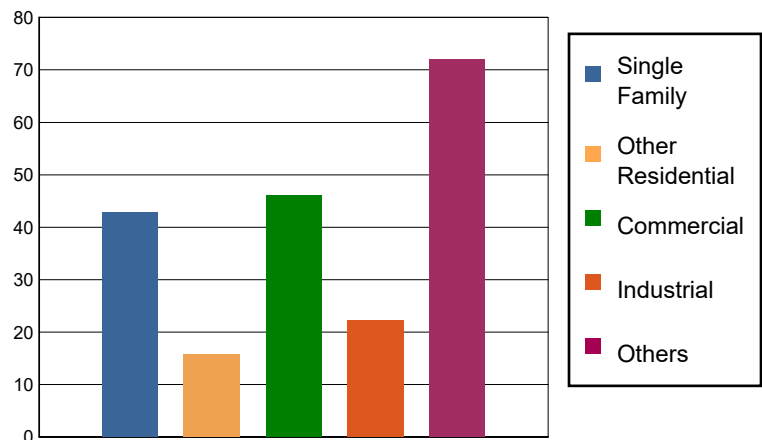


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.5304	4.2837	0.3814	1.4429	6.6384
	Capital-Related	0.0000	0.2248	3.3456	0.2253	0.6063	4.4020
	Rental	0.7175	1.0853	2.4251	0.1454	0.4393	4.8126
	Relocation	2.5676	0.6769	3.4952	0.7131	6.5580	14.0108
	<b>Subtotal</b>	<b>3.2851</b>	<b>2.5174</b>	<b>13.5496</b>	<b>1.4652</b>	<b>9.0465</b>	<b>29.8638</b>
<b>Capital Stock Losses</b>							
	Structural	5.0628	1.7580	6.3421	3.0478	13.9755	30.1862
	Non_Structural	24.8611	9.1829	18.1270	10.3285	34.1806	96.6801
	Content	9.6049	2.2230	7.9435	6.5989	14.5441	40.9144
	Inventory	0.0000	0.0000	0.1649	0.8749	0.3142	1.3540
	<b>Subtotal</b>	<b>39.5288</b>	<b>13.1639</b>	<b>32.5775</b>	<b>20.8501</b>	<b>63.0144</b>	<b>169.1347</b>
	<b>Total</b>	<b>42.81</b>	<b>15.68</b>	<b>46.13</b>	<b>22.32</b>	<b>72.06</b>	<b>199.00</b>

## 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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	334.7592	0.0000	0.00
	Bridges	90.1624	21.5627	23.92
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>424.9216</b>	<b>21.5627</b>	
Railways	Segments	13.2639	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>13.2639</b>	<b>0.0000</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	1.9970	0.8130	40.71
	Subtotal	<b>1.9970</b>	<b>0.8130</b>	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	<b>Total</b>	<b>440.18</b>	<b>22.38</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.2787	0.0000	0.00
	Subtotal	<b>4.2787</b>	<b>0.0000</b>	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.5672	0.0000	0.00
	Subtotal	<b>2.5672</b>	<b>0.0000</b>	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.7115	0.0000	0.00
	Subtotal	<b>1.7115</b>	<b>0.0000</b>	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	Total	<b>8.56</b>	<b>0.00</b>	



FEMA

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## **Appendix A: County Listing for the Region**

Middlesex, CT

**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	Middlesex	4,629	534	284	819
Total Region		4,629	534	284	819



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## Hazus: Earthquake Global Risk Report

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**Region Name:** DeepRiver

**Earthquake Scenario:** Portland

**Print Date:** October 16, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) 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 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 819 (millions of dollars). Approximately 89.00 % 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 440 and 8 (millions of dollars), respectively.

## **Building and Lifeline Inventory**

### **Building Inventory**

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 819 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region 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 beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no 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 448.00 (millions of dollars). This inventory includes over 31.07 miles of highways, 15 bridges, 265.33 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

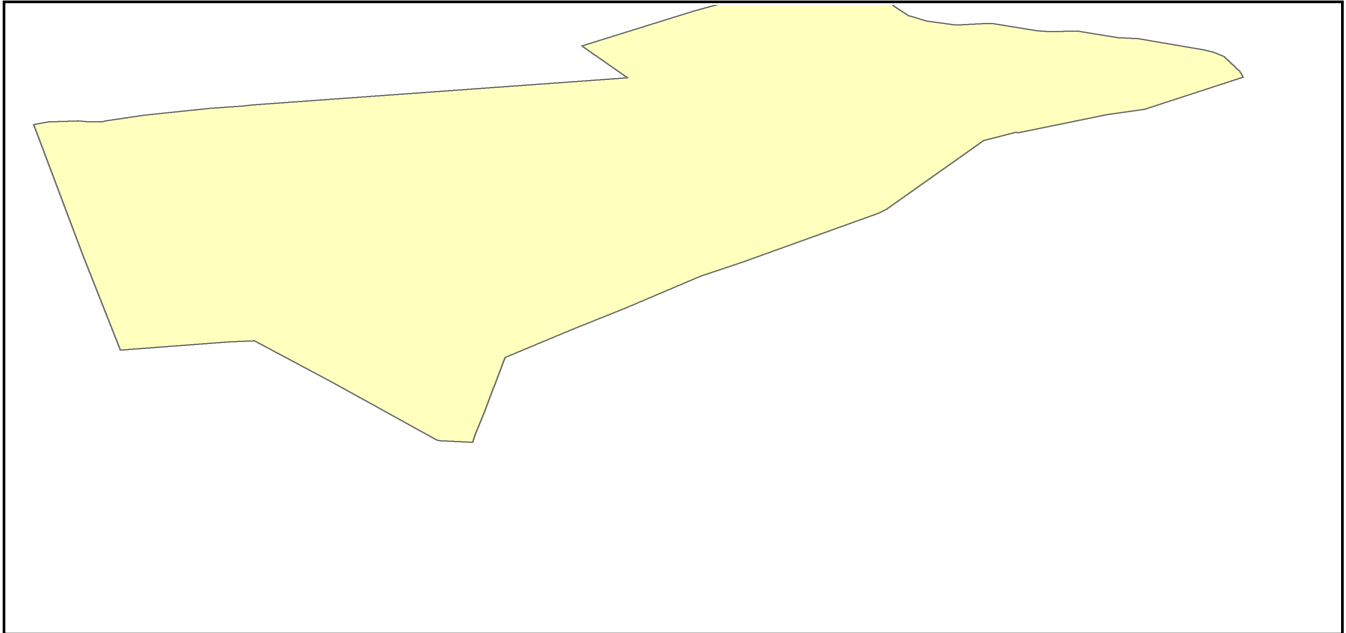
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	90.1624
	Segments	12	334.7592
	Tunnels	0	0.0000
	Subtotal		<b>424.9216</b>
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	2	13.2639
	Tunnels	0	0.0000
	Subtotal		<b>13.2639</b>
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
Bus	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Ferry	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Port	Facilities	1	1.9970
	Subtotal		<b>1.9970</b>
Airport	Facilities	0	0.0000
	Runways	0	0.0000
	Subtotal		<b>0.0000</b>
		Total	<b>440.20</b>

**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Potable Water</b>	Distribution Lines	NA	4.2787
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>4.2787</b>
<b>Waste Water</b>	Distribution Lines	NA	2.5672
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>2.5672</b>
<b>Natural Gas</b>	Distribution Lines	NA	1.7115
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>1.7115</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Communication</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
		<b>Total</b>	<b>8.60</b>

## Earthquake Scenario

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



<b>Scenario Name</b>	Portland
<b>Type of Earthquake</b>	Arbitrary
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	NA
<b>Longitude of Epicenter</b>	-72.60
<b>Latitude of Epicenter</b>	41.60
<b>Earthquake Magnitude</b>	5.70
<b>Depth (km)</b>	10.00
<b>Rupture Length (Km)</b>	NA
<b>Rupture Orientation (degrees)</b>	NA
<b>Attenuation Function</b>	Central & East US (CEUS 2008)

## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 154 buildings will be at least moderately damaged. This is over 8.00 % of the buildings in the region. There are an estimated 4 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.

### Damage Categories by General Occupancy Type

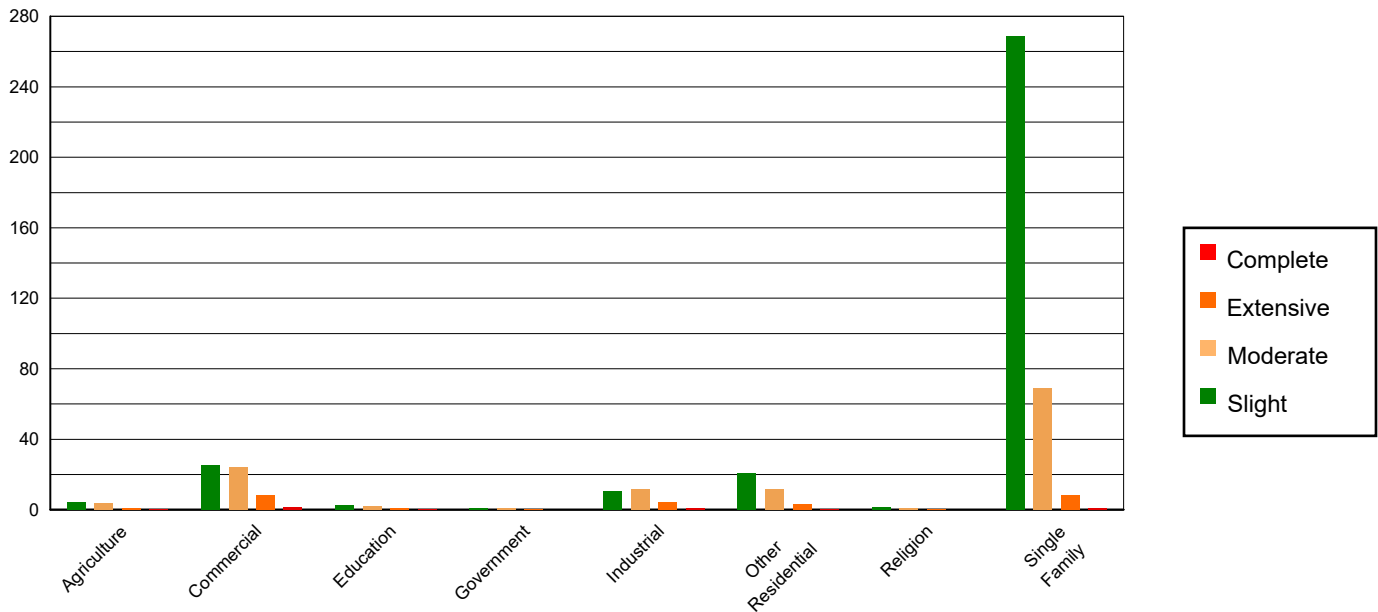


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	9.70	0.64	4.54	1.36	3.44	2.78	1.12	4.25	0.20	4.58
Commercial	58.87	3.90	25.33	7.58	24.06	19.43	8.19	31.16	1.55	36.32
Education	5.58	0.37	2.30	0.69	2.27	1.84	0.70	2.67	0.14	3.35
Government	1.87	0.12	0.82	0.25	0.93	0.75	0.32	1.21	0.06	1.49
Industrial	23.64	1.57	10.42	3.12	11.80	9.53	4.33	16.47	0.81	19.12
Other Residential	85.27	5.65	20.64	6.18	11.43	9.23	3.14	11.95	0.53	12.38
Religion	5.10	0.34	1.45	0.43	1.06	0.86	0.33	1.27	0.06	1.39
Single Family	1318.50	87.40	268.58	80.39	68.85	55.59	8.16	31.02	0.91	21.37
<b>Total</b>	<b>1,509</b>		<b>334</b>		<b>124</b>		<b>26</b>		<b>4</b>	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	1364.78	90.47	278.18	83.27	65.66	53.02	5.24	19.92	0.20	4.81
<b>Steel</b>	38.27	2.54	19.31	5.78	26.40	21.32	10.21	38.82	2.10	49.20
<b>Concrete</b>	7.22	0.48	3.49	1.04	5.02	4.05	1.73	6.59	0.34	7.87
<b>Precast</b>	3.10	0.21	1.02	0.30	1.46	1.18	0.72	2.73	0.05	1.19
<b>RM</b>	17.84	1.18	3.75	1.12	4.26	3.44	1.54	5.87	0.04	0.91
<b>URM</b>	77.30	5.12	28.33	8.48	21.05	16.99	6.85	26.07	1.53	36.01
<b>MH</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,509</b>		<b>334</b>		<b>124</b>		<b>26</b>		<b>4</b>	

\*Note:

RM      Reinforced Masonry  
 URM     Unreinforced Masonry  
 MH      Manufactured Housing



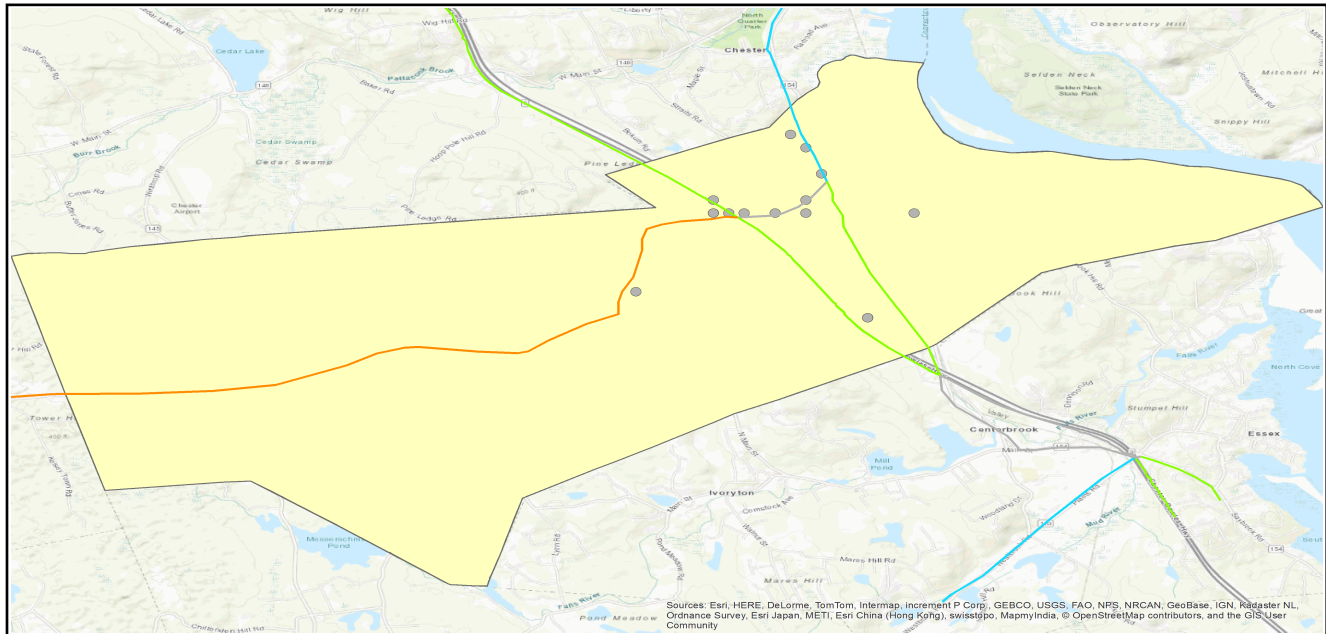
### **Essential Facility Damage**

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	4	0	0	4
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	2	0	0	2

## Transportation Lifeline Damage



**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	7	7
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	1	1
	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	1	0	0	1	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

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 (miles)	Number of Leaks	Number of Breaks
Potable Water	133	0	0
Waste Water	80	0	0
Natural Gas	53	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						
Electric Power						

## Induced Earthquake Damage

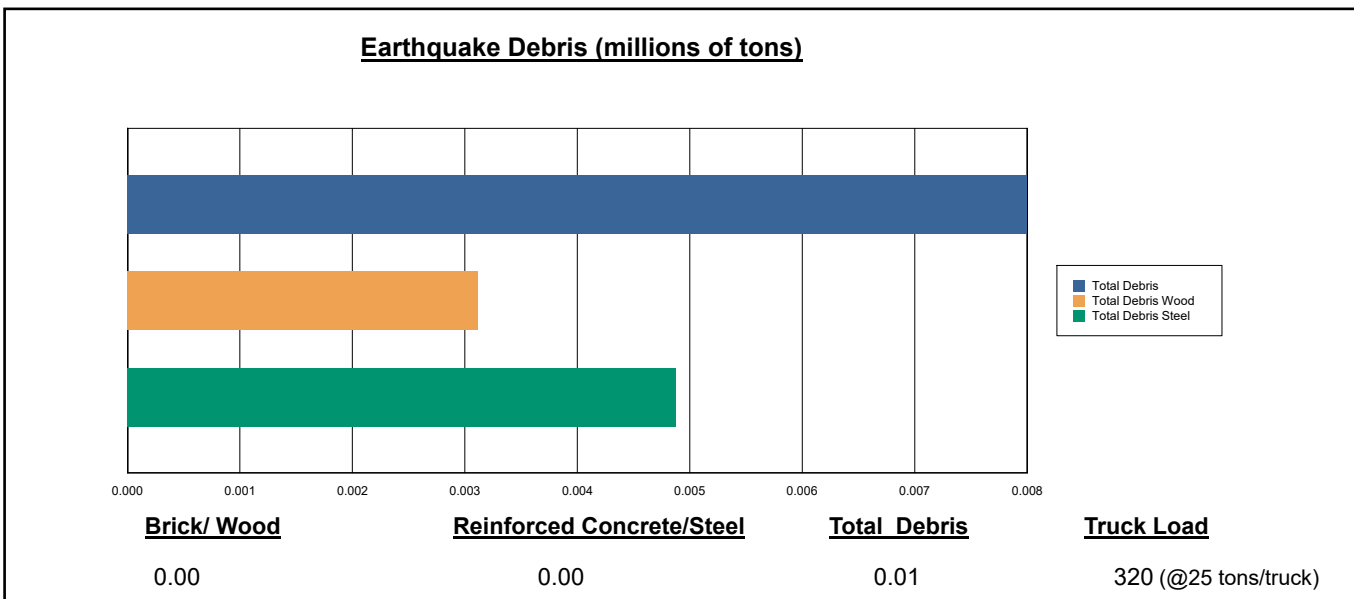
### Fire Following Earthquake

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 8,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 39.00% 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 320 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

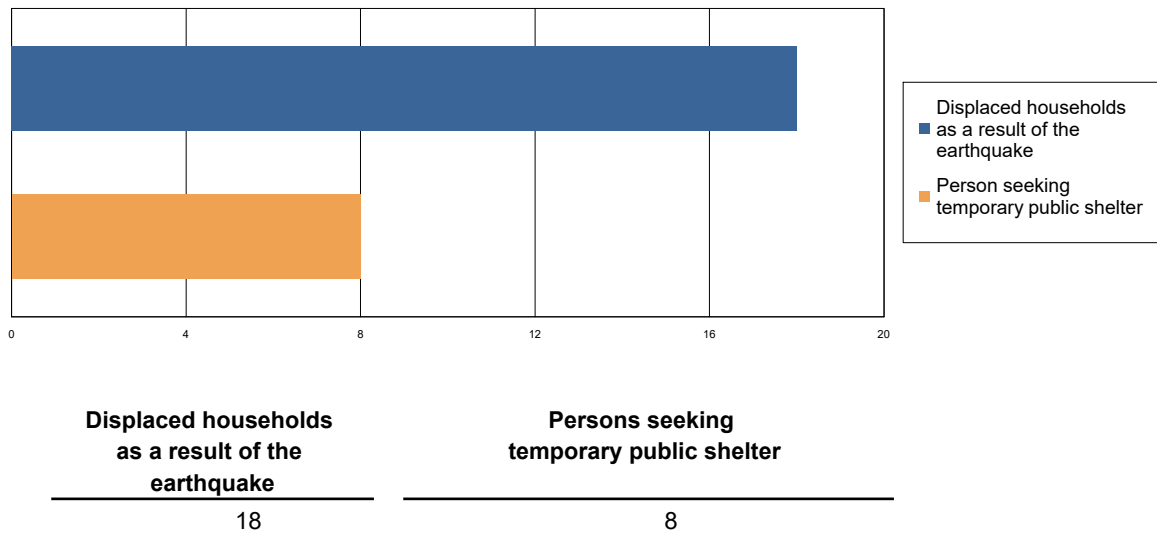


## Social Impact

### 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 18 households to be displaced due to the earthquake. Of these, 8 people (out of a total population of 4,629) will seek temporary shelter in public shelters.

#### Displaced Households/ Persons Seeking Short Term Public Shelter



### 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
<b>2 AM</b>	Commercial	0.12	0.02	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.20	0.04	0.00	0.01
	Other-Residential	0.89	0.17	0.02	0.04
	Single Family	1.25	0.16	0.01	0.03
	<b>Total</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>2 PM</b>	Commercial	6.85	1.35	0.15	0.30
	Commuting	0.01	0.01	0.01	0.00
	Educational	1.73	0.36	0.05	0.09
	Hotels	0.00	0.00	0.00	0.00
	Industrial	1.45	0.29	0.03	0.07
	Other-Residential	0.17	0.03	0.00	0.01
	Single Family	0.23	0.03	0.00	0.01
	<b>Total</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>0</b>
<b>5 PM</b>	Commercial	4.85	0.96	0.11	0.21
	Commuting	0.14	0.17	0.31	0.06
	Educational	0.19	0.04	0.01	0.01
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.90	0.18	0.02	0.04
	Other-Residential	0.35	0.07	0.01	0.02
	Single Family	0.48	0.07	0.01	0.01
	<b>Total</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>0</b>

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## Economic Loss

The total economic loss estimated for the earthquake is 41.23 (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.

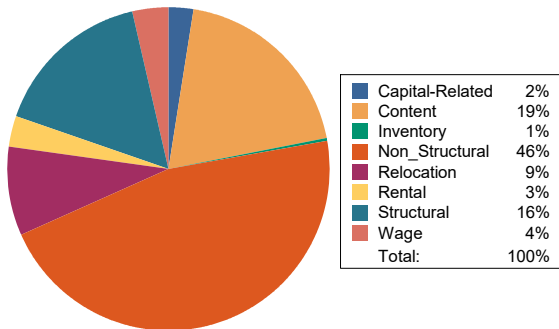


## Building-Related Losses

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 35.72 (millions of dollars); 18 % 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 36 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

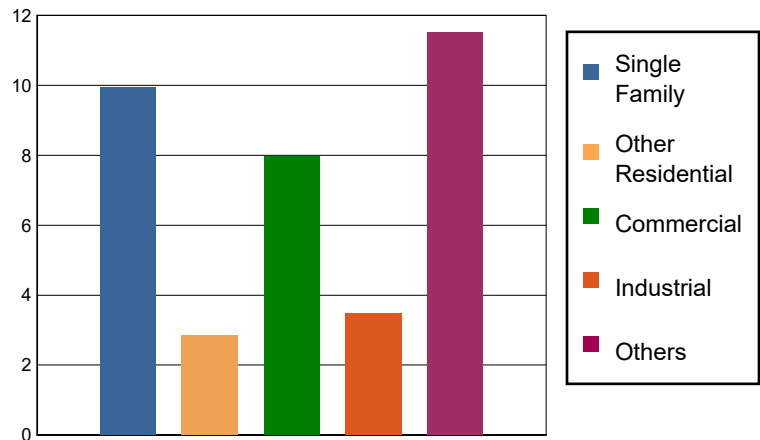


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.0877	0.8940	0.0837	0.2736	1.3390
	Capital-Related	0.0000	0.0371	0.6878	0.0496	0.1067	0.8812
	Rental	0.1472	0.2089	0.5719	0.0371	0.0933	1.0584
	Relocation	0.5117	0.1475	0.8414	0.2102	1.4228	3.1336
	<b>Subtotal</b>	<b>0.6589</b>	<b>0.4812</b>	<b>2.9951</b>	<b>0.3806</b>	<b>1.8964</b>	<b>6.4122</b>
<b>Capital Stock Losses</b>							
	Structural	1.1320	0.3328	1.1783	0.6093	2.4953	5.7477
	Non_Structural	5.8863	1.6033	2.6043	1.4415	4.9190	16.4544
	Content	2.2533	0.4212	1.1641	0.9196	2.1509	6.9091
	Inventory	0.0000	0.0000	0.0238	0.1221	0.0465	0.1924
	<b>Subtotal</b>	<b>9.2716</b>	<b>2.3573</b>	<b>4.9705</b>	<b>3.0925</b>	<b>9.6117</b>	<b>29.3036</b>
	<b>Total</b>	<b>9.93</b>	<b>2.84</b>	<b>7.97</b>	<b>3.47</b>	<b>11.51</b>	<b>35.72</b>

## 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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	334.7592	0.0000	0.00
	Bridges	90.1624	5.2413	5.81
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>424.9216</b>	<b>5.2413</b>	
Railways	Segments	13.2639	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>13.2639</b>	<b>0.0000</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	1.9970	0.2760	13.82
	Subtotal	<b>1.9970</b>	<b>0.2760</b>	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	<b>Total</b>	<b>440.18</b>	<b>5.52</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.2787	0.0000	0.00
	Subtotal	<b>4.2787</b>	<b>0.0000</b>	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.5672	0.0000	0.00
	Subtotal	<b>2.5672</b>	<b>0.0000</b>	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.7115	0.0000	0.00
	Subtotal	<b>1.7115</b>	<b>0.0000</b>	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	Total	<b>8.56</b>	<b>0.00</b>	



FEMA

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## **Appendix A: County Listing for the Region**

Middlesex, CT

**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	Middlesex	4,629	534	284	819
Total Region		4,629	534	284	819



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## Hazus: Earthquake Global Risk Report

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**Region Name:** DeepRiver

**Earthquake Scenario:** Stamford

**Print Date:** October 16, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) 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 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 819 (millions of dollars). Approximately 89.00 % 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 440 and 8 (millions of dollars), respectively.



## **Building and Lifeline Inventory**

### **Building Inventory**

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 819 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region 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 beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no 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 448.00 (millions of dollars). This inventory includes over 31.07 miles of highways, 15 bridges, 265.33 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

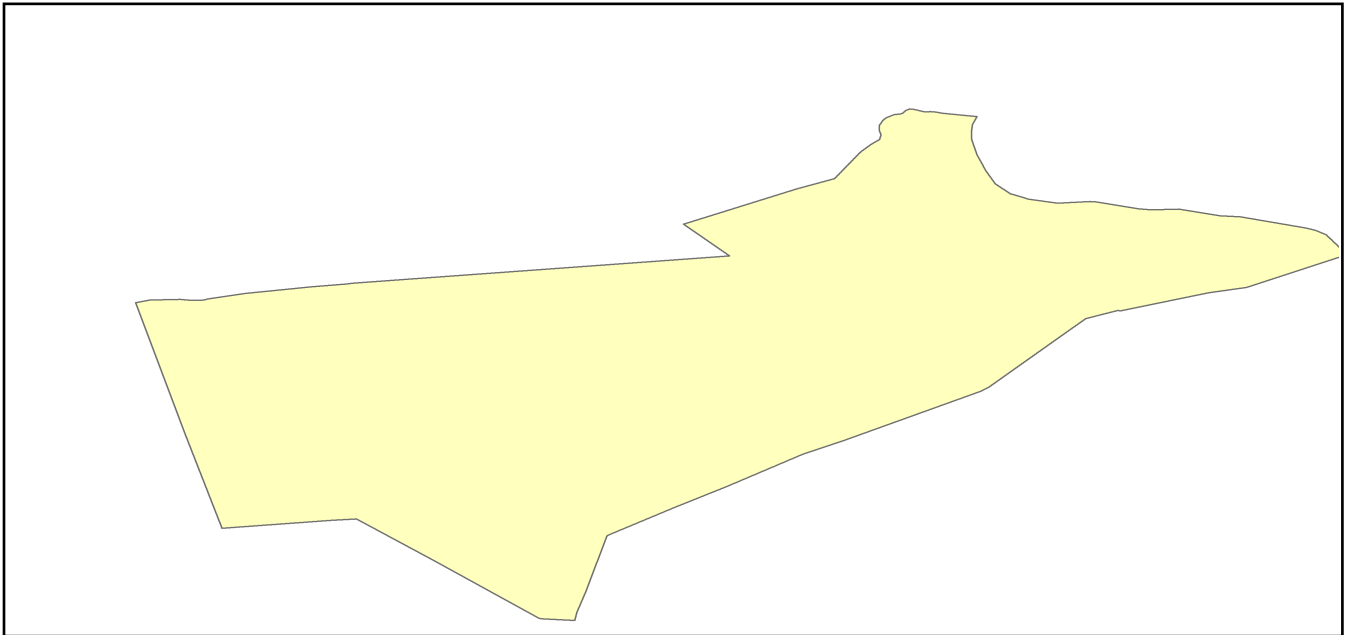
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	90.1624
	Segments	12	334.7592
	Tunnels	0	0.0000
	Subtotal		<b>424.9216</b>
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	2	13.2639
	Tunnels	0	0.0000
	Subtotal		<b>13.2639</b>
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
Bus	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Ferry	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Port	Facilities	1	1.9970
	Subtotal		<b>1.9970</b>
Airport	Facilities	0	0.0000
	Runways	0	0.0000
	Subtotal		<b>0.0000</b>
		Total	<b>440.20</b>

**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Potable Water</b>	Distribution Lines	NA	4.2787
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>4.2787</b>
<b>Waste Water</b>	Distribution Lines	NA	2.5672
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>2.5672</b>
<b>Natural Gas</b>	Distribution Lines	NA	1.7115
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>1.7115</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Communication</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
		<b>Total</b>	<b>8.60</b>

## Earthquake Scenario

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



<b>Scenario Name</b>	Stamford
<b>Type of Earthquake</b>	Arbitrary
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	NA
<b>Longitude of Epicenter</b>	-73.56
<b>Latitude of Epicenter</b>	41.11
<b>Earthquake Magnitude</b>	5.70
<b>Depth (km)</b>	10.00
<b>Rupture Length (Km)</b>	NA
<b>Rupture Orientation (degrees)</b>	NA
<b>Attenuation Function</b>	Central & East US (CEUS 2008)

## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 9 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.

### Damage Categories by General Occupancy Type

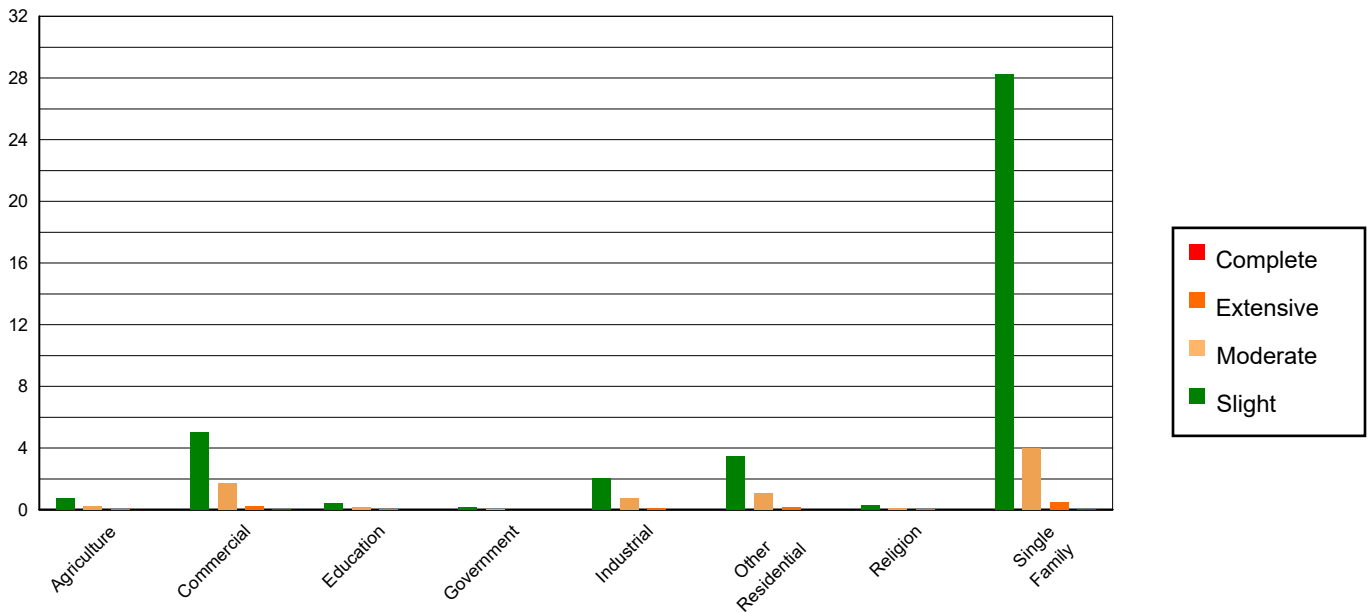


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	17.99	0.92	0.76	1.88	0.22	2.70	0.03	2.82	0.00	1.88
Commercial	111.00	5.70	5.00	12.36	1.75	21.57	0.23	22.87	0.02	21.48
Education	10.41	0.53	0.43	1.06	0.14	1.78	0.02	1.73	0.00	1.99
Government	3.79	0.19	0.16	0.38	0.05	0.65	0.01	0.60	0.00	0.52
Industrial	48.10	2.47	2.06	5.09	0.74	9.16	0.09	9.09	0.01	6.89
Other Residential	116.25	5.97	3.48	8.61	1.10	13.57	0.15	15.12	0.01	18.21
Religion	7.56	0.39	0.31	0.76	0.12	1.43	0.02	1.68	0.00	2.07
Single Family	1632.24	83.82	28.27	69.85	3.98	49.14	0.47	46.09	0.03	46.97
<b>Total</b>	<b>1,947</b>		<b>40</b>		<b>8</b>		<b>1</b>		<b>0</b>	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	1685.51	86.55	26.15	64.62	2.24	27.67	0.17	16.47	0.00	0.00
<b>Steel</b>	91.47	4.70	3.51	8.68	1.19	14.63	0.12	11.64	0.00	3.07
<b>Concrete</b>	17.02	0.87	0.60	1.48	0.18	2.17	0.01	0.84	0.00	0.00
<b>Precast</b>	5.82	0.30	0.31	0.75	0.19	2.38	0.03	3.36	0.00	0.63
<b>RM</b>	26.14	1.34	0.82	2.03	0.42	5.14	0.06	5.55	0.00	0.00
<b>URM</b>	121.38	6.23	9.08	22.44	3.89	48.01	0.63	62.14	0.07	96.30
<b>MH</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,947</b>		<b>40</b>		<b>8</b>		<b>1</b>		<b>0</b>	

\*Note:

RM      Reinforced Masonry  
 URM     Unreinforced Masonry  
 MH      Manufactured Housing

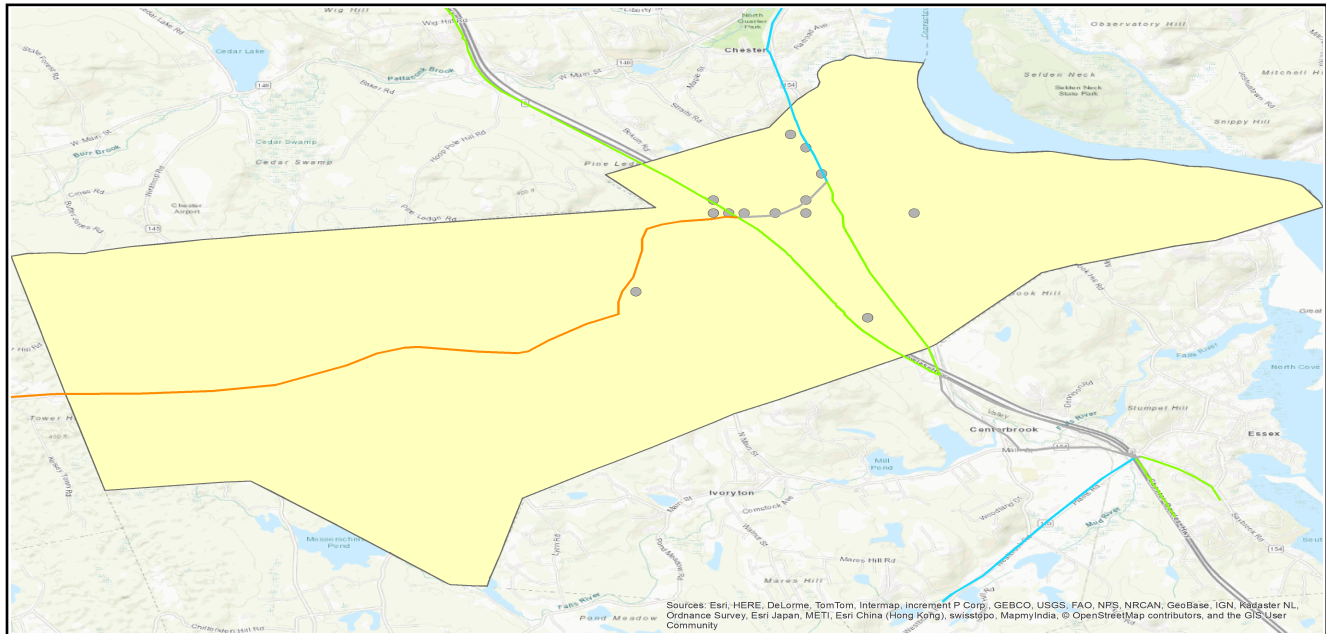
### **Essential Facility Damage**

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	4	0	0	4
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	2	0	0	2

## Transportation Lifeline Damage





**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	7	7
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	1	1
	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	1	0	0	1	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

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 (miles)	Number of Leaks	Number of Breaks
Potable Water	133	0	0
Waste Water	80	0	0
Natural Gas	53	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						
Electric Power						

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 tons of debris will be generated. Of the total amount, Brick/Wood comprises 70.00% 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.

Earthquake Debris (millions of tons)			
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	0 (@25 tons/truck)

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 4,629) will seek temporary shelter in public shelters.

<b><u>Displaced Households/ Persons Seeking Short Term Public Shelter</u></b>	
<b>Displaced households as a result of the earthquake</b>	<b>Persons seeking temporary public shelter</b>
0	0

**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
<b>2 AM</b>	Commercial	0.01	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.01	0.00	0.00	0.00
	Other-Residential	0.06	0.01	0.00	0.00
	Single Family	0.09	0.01	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>2 PM</b>	Commercial	0.30	0.04	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.07	0.01	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.05	0.01	0.00	0.00
	Other-Residential	0.01	0.00	0.00	0.00
	Single Family	0.02	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>5 PM</b>	Commercial	0.21	0.03	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.01	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.03	0.00	0.00	0.00
	Other-Residential	0.02	0.00	0.00	0.00
	Single Family	0.03	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

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## Economic Loss

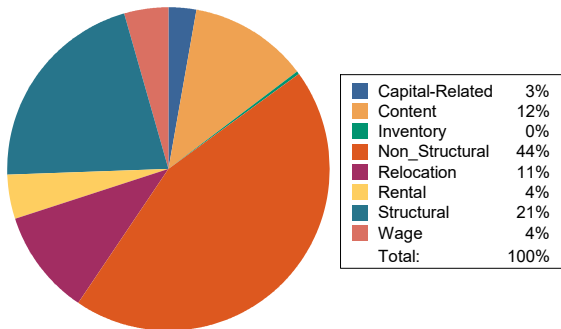
The total economic loss estimated for the earthquake is 1.53 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

## 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 1.41 (millions of dollars); 22 % 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 40 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

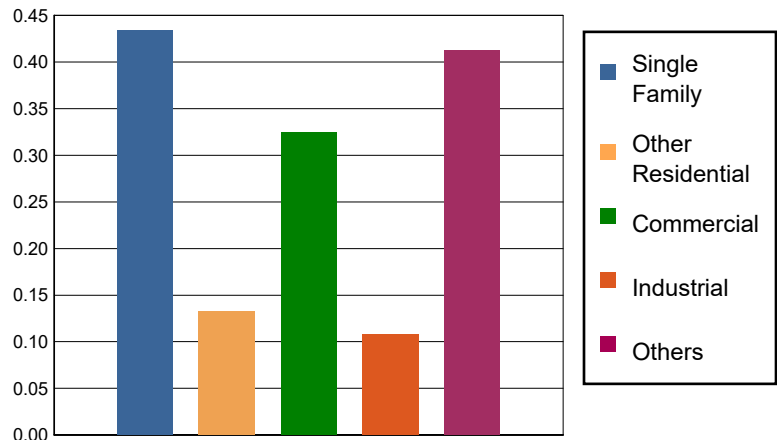


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.0031	0.0433	0.0030	0.0132	0.0626
	Capital-Related	0.0000	0.0013	0.0316	0.0018	0.0049	0.0396
	Rental	0.0090	0.0142	0.0328	0.0017	0.0040	0.0617
	Relocation	0.0290	0.0108	0.0423	0.0099	0.0593	0.1513
	<b>Subtotal</b>	<b>0.0380</b>	<b>0.0294</b>	<b>0.1500</b>	<b>0.0164</b>	<b>0.0814</b>	<b>0.3152</b>
<b>Capital Stock Losses</b>							
	Structural	0.0818	0.0242	0.0556	0.0256	0.1103	0.2975
	Non_Structural	0.2647	0.0683	0.0885	0.0395	0.1637	0.6247
	Content	0.0497	0.0103	0.0298	0.0227	0.0560	0.1685
	Inventory	0.0000	0.0000	0.0006	0.0030	0.0011	0.0047
	<b>Subtotal</b>	<b>0.3962</b>	<b>0.1028</b>	<b>0.1745</b>	<b>0.0908</b>	<b>0.3311</b>	<b>1.0954</b>
	<b>Total</b>	<b>0.43</b>	<b>0.13</b>	<b>0.32</b>	<b>0.11</b>	<b>0.41</b>	<b>1.41</b>

## 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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	334.7592	0.0000	0.00
	Bridges	90.1624	0.1028	0.11
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>424.9216</b>	<b>0.1028</b>	
Railways	Segments	13.2639	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>13.2639</b>	<b>0.0000</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	1.9970	0.0185	0.93
	Subtotal	<b>1.9970</b>	<b>0.0185</b>	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	<b>Total</b>	<b>440.18</b>	<b>0.12</b>	



**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.2787	0.0000	0.00
	Subtotal	<b>4.2787</b>	<b>0.0000</b>	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.5672	0.0000	0.00
	Subtotal	<b>2.5672</b>	<b>0.0000</b>	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.7115	0.0000	0.00
	Subtotal	<b>1.7115</b>	<b>0.0000</b>	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	Total	<b>8.56</b>	<b>0.00</b>	



FEMA

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## **Appendix A: County Listing for the Region**

Middlesex, CT

**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	Middlesex	4,629	534	284	819
Total Region		4,629	534	284	819



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## Hazus: Earthquake Global Risk Report

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**Region Name:** DeepRiver

**Earthquake Scenario:** Annualized

**Print Date:** October 16, 2019

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

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

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) 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 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 14.16 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 4,629 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 819 (millions of dollars). Approximately 89.00 % 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 440 and 8 (millions of dollars), respectively.

## **Building and Lifeline Inventory**

### **Building Inventory**

Hazus estimates that there are 1 thousand buildings in the region which have an aggregate total replacement value of 819 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region 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 beds. There are 4 schools, 2 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no 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 448.00 (millions of dollars). This inventory includes over 31.07 miles of highways, 15 bridges, 265.33 miles of pipes.

**Table 1: Transportation System Lifeline Inventory**

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	90.1624
	Segments	12	334.7592
	Tunnels	0	0.0000
	Subtotal		<b>424.9216</b>
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	2	13.2639
	Tunnels	0	0.0000
	Subtotal		<b>13.2639</b>
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		<b>0.0000</b>
Bus	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Ferry	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
Port	Facilities	1	1.9970
	Subtotal		<b>1.9970</b>
Airport	Facilities	0	0.0000
	Runways	0	0.0000
	Subtotal		<b>0.0000</b>
		Total	<b>440.20</b>

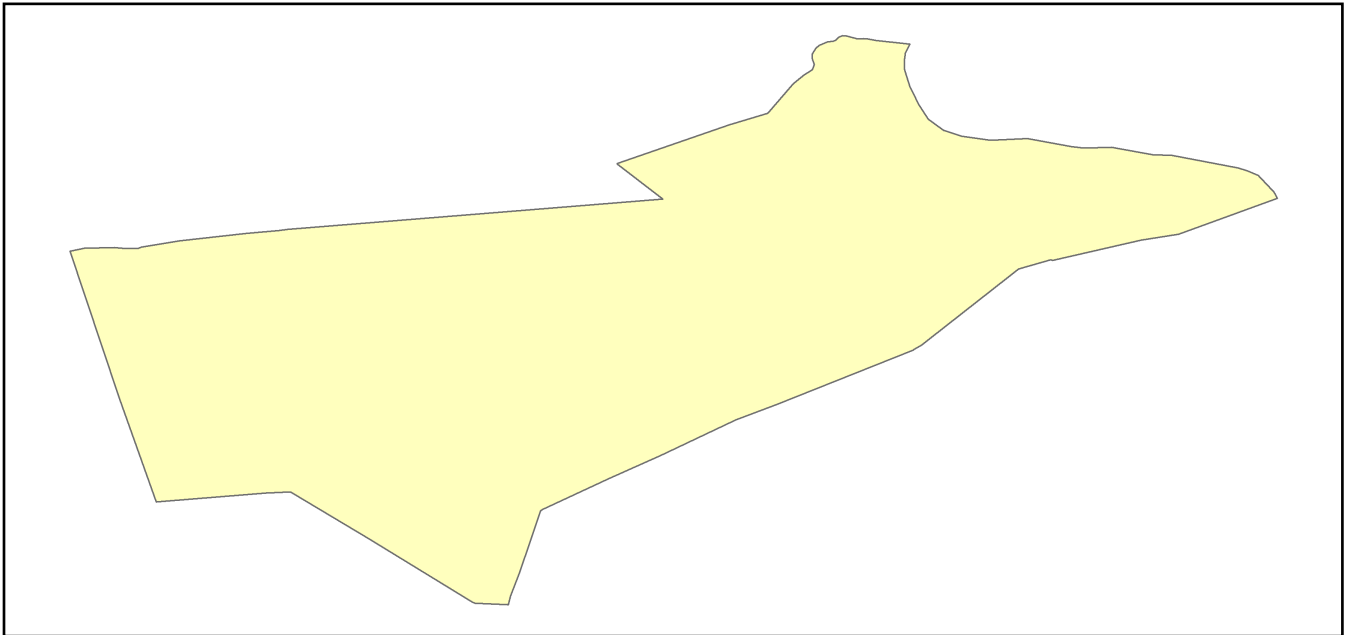


**Table 2: Utility System Lifeline Inventory**

System	Component	# Locations / Segments	Replacement value (millions of dollars)
<b>Potable Water</b>	Distribution Lines	NA	4.2787
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>4.2787</b>
<b>Waste Water</b>	Distribution Lines	NA	2.5672
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>2.5672</b>
<b>Natural Gas</b>	Distribution Lines	NA	1.7115
	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>1.7115</b>
<b>Oil Systems</b>	Facilities	0	0.0000
	Pipelines	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Electrical Power</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
<b>Communication</b>	Facilities	0	0.0000
	Subtotal		<b>0.0000</b>
		<b>Total</b>	<b>8.60</b>

## Earthquake Scenario

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



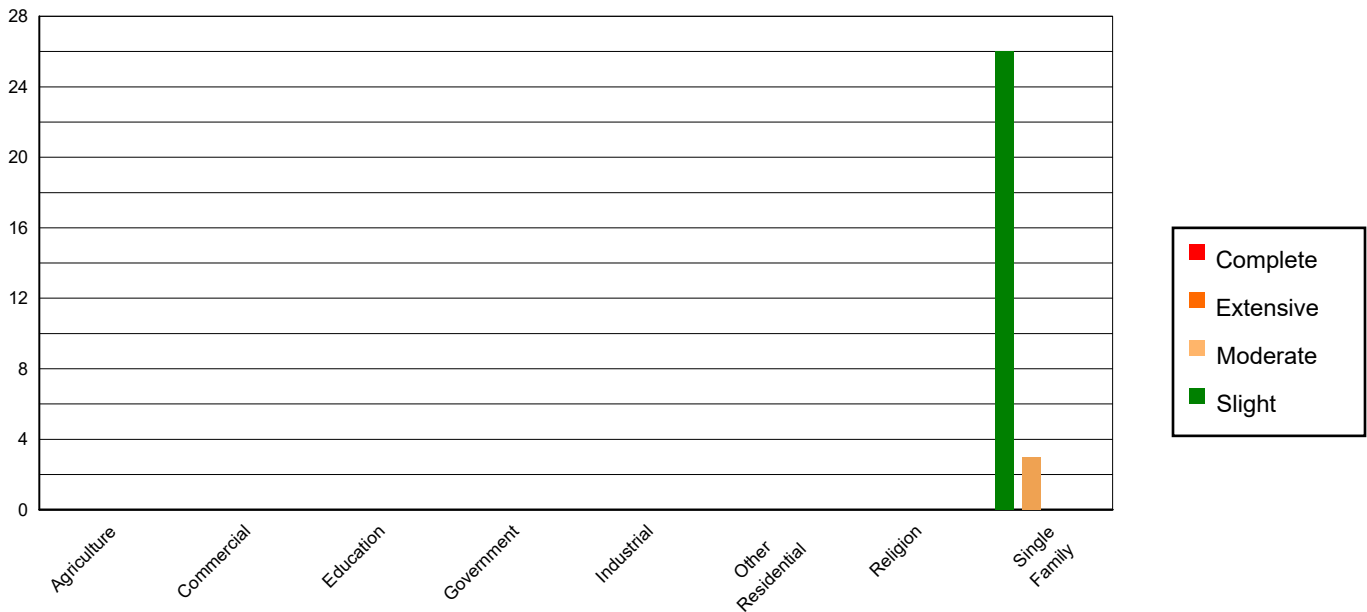
Scenario Name	Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function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

## Direct Earthquake Damage

### Building Damage

Hazus estimates that about 3 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.

### Damage Categories by General Occupancy Type



**Table 3: Expected Building Damage by Occupancy**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Agriculture</b>	11.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Commercial</b>	56.00	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Education</b>	2.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Government</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Industrial</b>	20.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Other Residential</b>	97.00	5.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Religion</b>	3.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Single Family</b>	1631.00	89.62	26.00	100.00	3.00	100.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,820</b>		<b>26</b>		<b>3</b>		<b>0</b>		<b>0</b>	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1672.00	91.87	23.00	88.46	2.00	66.67	0.00	0.00	0.00	0.00
Steel	39.00	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete	2.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Precast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RM	6.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URM	101.00	5.55	3.00	11.54	1.00	33.33	0.00	0.00	0.00	0.00
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>1,820</b>		<b>26</b>		<b>3</b>		<b>0</b>		<b>0</b>	

\*Note:

RM      Reinforced Masonry  
 URM     Unreinforced Masonry  
 MH      Manufactured Housing

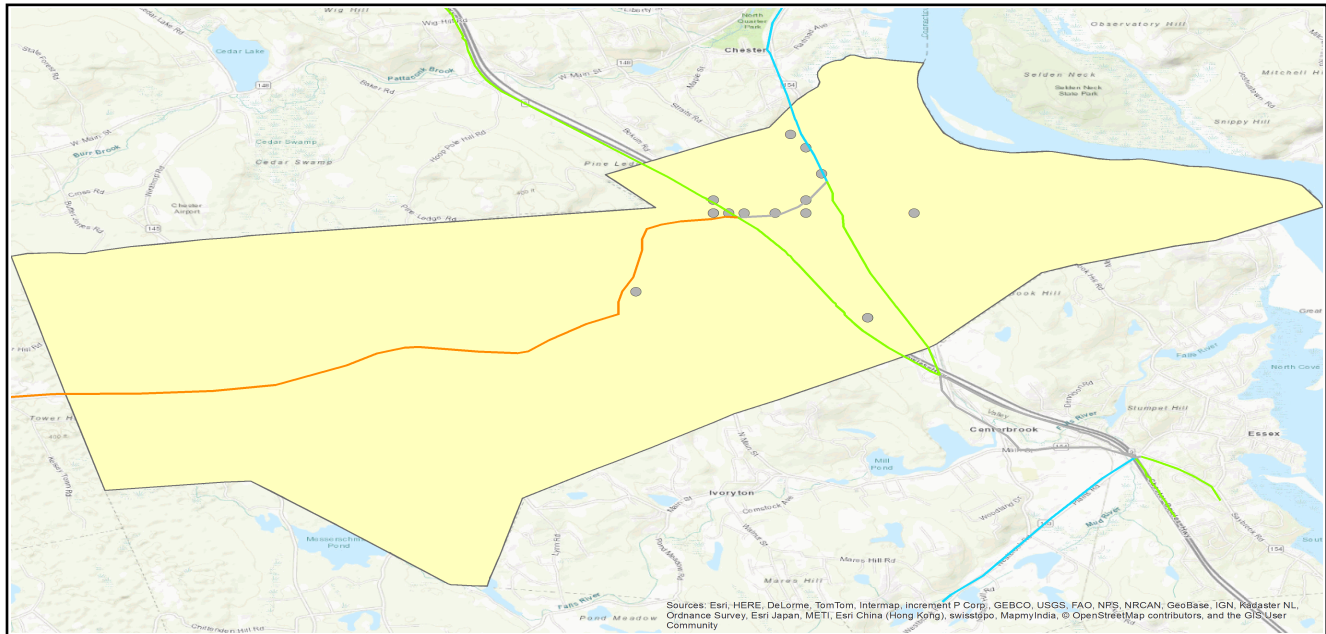
### **Essential Facility Damage**

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	4	0	0	4
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	2	0	0	2

## Transportation Lifeline Damage



**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	7	7
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	1	1
	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	1	0	0	1	1
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Table 6 provides damage estimates for the transportation system.

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 (miles)	Number of Leaks	Number of Breaks
Potable Water	133	0	0
Waste Water	80	0	0
Natural Gas	53	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						
Electric Power						



# 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 tons of debris will be generated. Of the total amount, Brick/Wood comprises 70.00% 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.

Earthquake Debris (millions of tons)			
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	0 (@25 tons/truck)

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 4,629) will seek temporary shelter in public shelters.

<u>Displaced Households/ Persons Seeking Short Term Public Shelter</u>	
Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

**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	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
2 PM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
5 PM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

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## Economic Loss

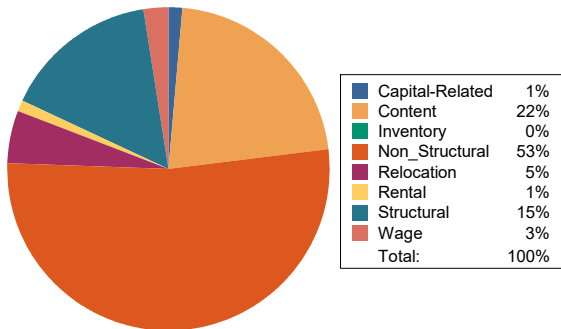
The total economic loss estimated for the earthquake is 0.13 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

## 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); 10 % 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 44 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type (\$ millions)



Earthquake Losses by Occupancy Type (\$ millions)

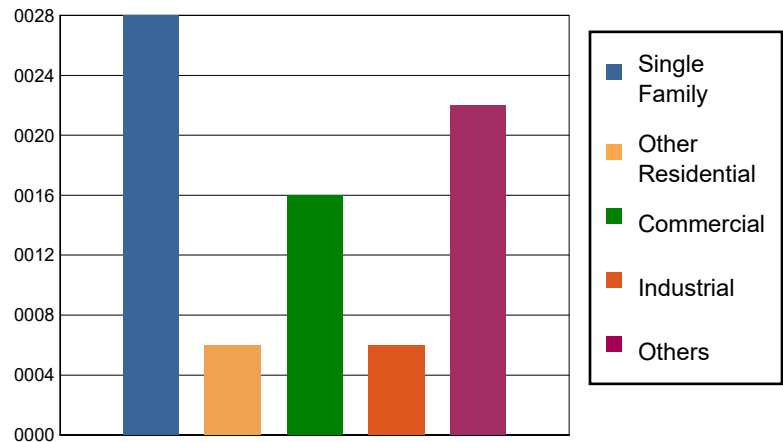


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.0000	0.0000	0.0002	0.0000	0.0000	0.0002
	Capital-Related	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001
	Rental	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001
	Relocation	0.0001	0.0000	0.0001	0.0000	0.0002	0.0004
	<b>Subtotal</b>	<b>0.0001</b>	<b>0.0000</b>	<b>0.0005</b>	<b>0.0000</b>	<b>0.0002</b>	<b>0.0008</b>
<b>Capital Stock Losses</b>							
	Structural	0.0003	0.0001	0.0002	0.0001	0.0005	0.0012
	Non_Structural	0.0018	0.0004	0.0006	0.0003	0.0010	0.0041
	Content	0.0006	0.0001	0.0003	0.0002	0.0005	0.0017
	Inventory	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	<b>Subtotal</b>	<b>0.0027</b>	<b>0.0006</b>	<b>0.0011</b>	<b>0.0006</b>	<b>0.0020</b>	<b>0.0070</b>
<b>Total</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>

## 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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	334.7592	0.0000	0.00
	Bridges	90.1624	0.1028	0.11
	Tunnels	0.0000	0.0000	0.00
	Subtotal	<b>424.9216</b>	<b>0.1028</b>	
Railways	Segments	13.2639	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>13.2639</b>	<b>0.0000</b>	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Port	Facilities	1.9970	0.0185	0.93
	Subtotal	<b>1.9970</b>	<b>0.0185</b>	
Airport	Facilities	0.0000	0.0000	0.00
	Runways	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	<b>Total</b>	<b>440.18</b>	<b>0.12</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.2787	0.0000	0.00
	Subtotal	<b>4.2787</b>	<b>0.0000</b>	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.5672	0.0000	0.00
	Subtotal	<b>2.5672</b>	<b>0.0000</b>	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.7115	0.0000	0.00
	Subtotal	<b>1.7115</b>	<b>0.0000</b>	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	<b>0.0000</b>	<b>0.0000</b>	
	Total	<b>8.56</b>	<b>0.00</b>	



FEMA

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## **Appendix A: County Listing for the Region**

Middlesex, CT



**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut	Middlesex	4,629	534	284	819
Total Region		4,629	534	284	819