



# Hazus-MH: Flood Global Risk Report

**Region Name:** Tioga\_0210  
**Flood Scenario:** Scenario\_all  
**Print Date:** Tuesday, May 30, 2017

**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):

- Pennsylvania

**Note:**

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

The geographical size of the region is 222 square miles and contains 3,046 census blocks. The region contains over 17 thousand households and has a total population of 41,981 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 21,005 buildings in the region with a total building replacement value (excluding contents) of 4,033 million dollars (2010 dollars). Approximately 94.85% of the buildings (and 77.78% of the building value)



are associated with residential housing.

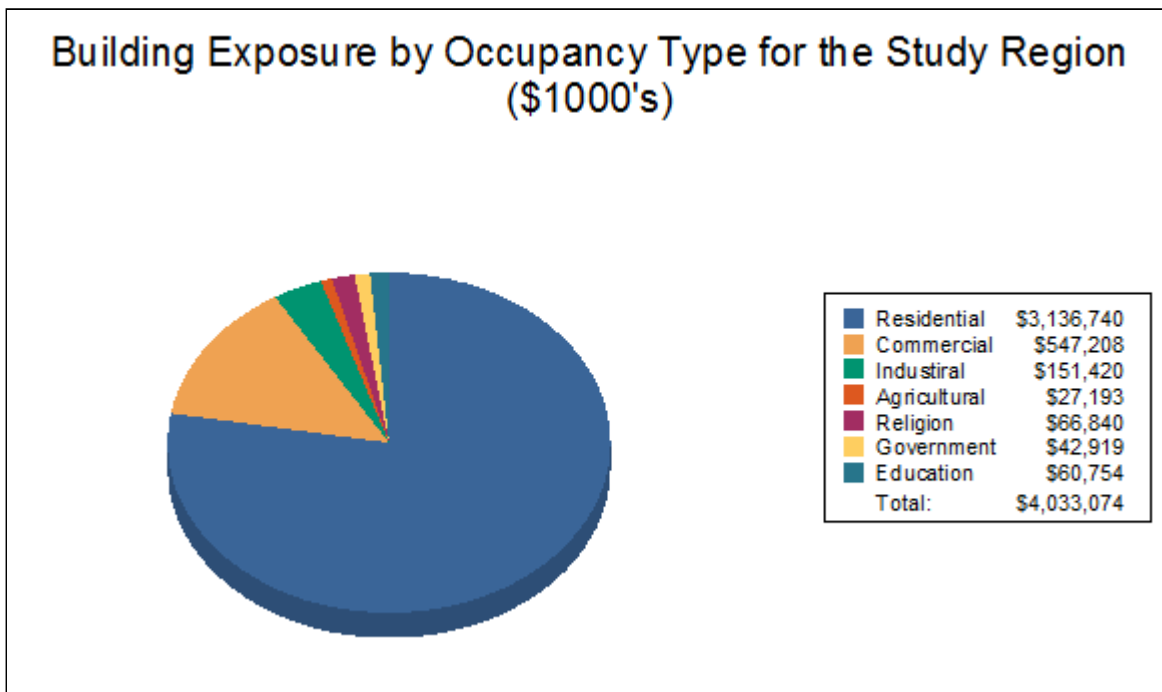
## Building Inventory

### General Building Stock

Hazus estimates that there are 21,005 buildings in the region which have an aggregate total replacement value of 4,033 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

**Table 1**  
**Building Exposure by Occupancy Type for the Study Region**

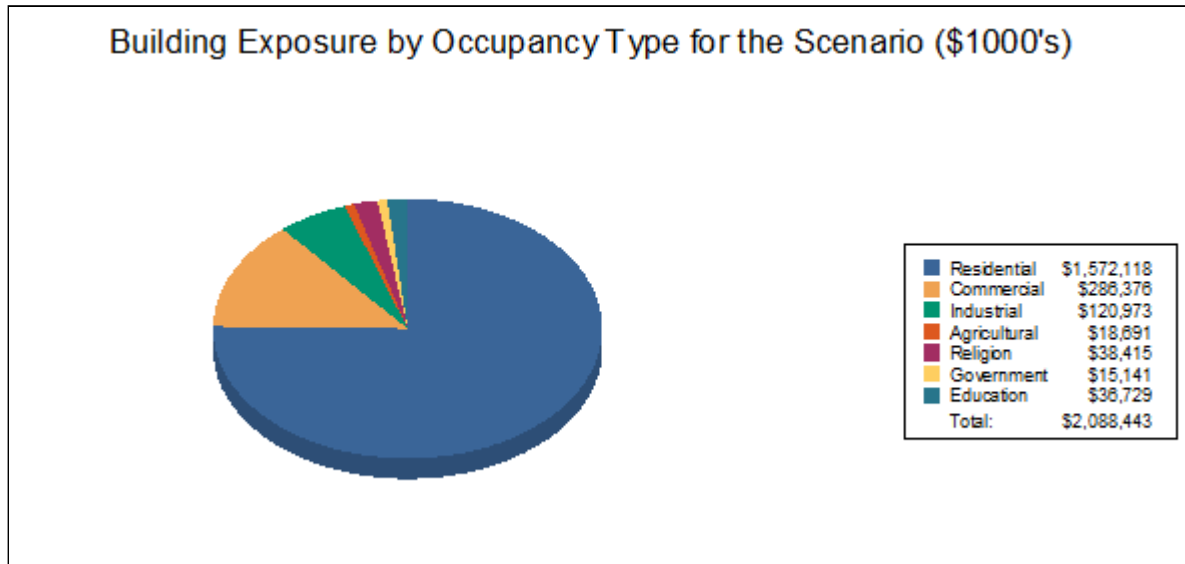
Occupancy	Exposure (\$1000)	Percent of Total
Residential	3,136,740	77.8%
Commercial	547,208	13.6%
Industrial	151,420	3.8%
Agricultural	27,193	0.7%
Religion	66,840	1.7%
Government	42,919	1.1%
Education	60,754	1.5%
<b>Total</b>	<b>4,033,074</b>	<b>100.0%</b>





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

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,572,118	75.3%
Commercial	286,376	13.7%
Industrial	120,973	5.8%
Agricultural	18,691	0.9%
Religion	38,415	1.8%
Government	15,141	0.7%
Education	36,729	1.8%
<b>Total</b>	<b>2,088,443</b>	<b>100.0%</b>



### Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 83 beds. There are 24 schools, 11 fire stations, 11 police stations and no emergency operation centers.

### Flood Scenario Parameters

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

<b>Study Region Name:</b>	Tioga_0210
<b>Scenario Name:</b>	Scenario_all
<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

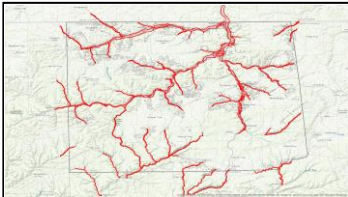


## Building Damage

### General Building Stock Damage

Hazus estimates that about 1,339 buildings will be at least moderately damaged. This is over 63% of the total number of buildings in the scenario. There are an estimated 239 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

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

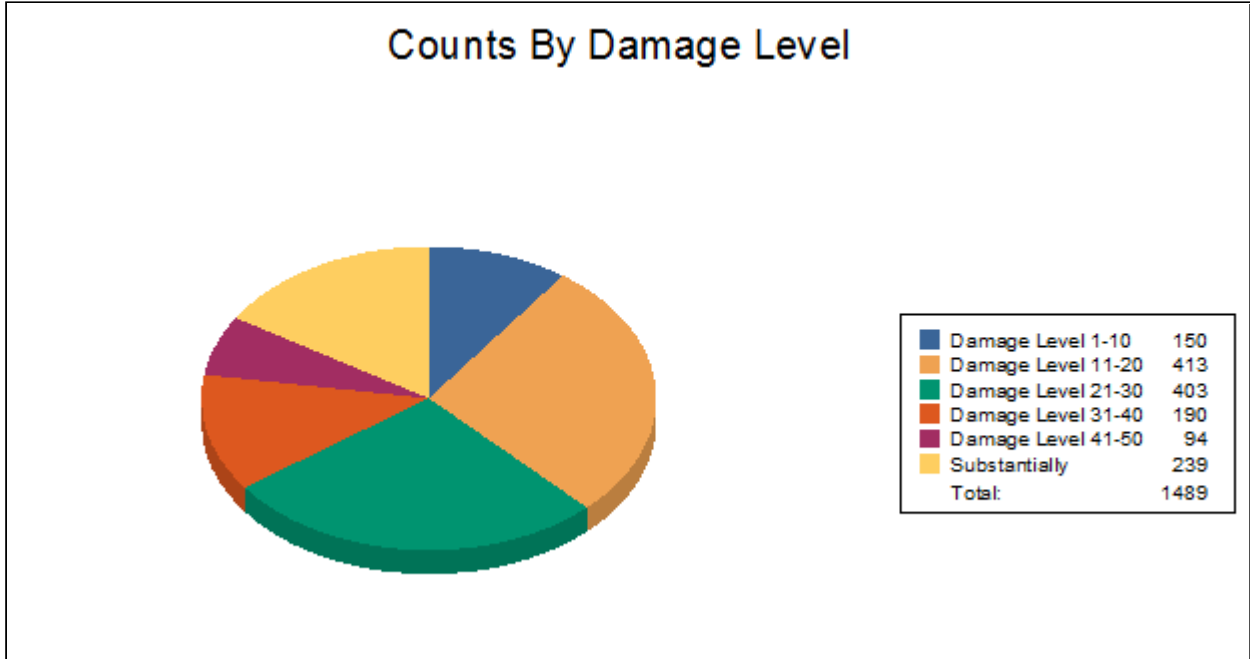


**Table 3: Expected Building Damage by Occupancy**

Occupancy	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	100.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	1	33.33	2	66.67	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Residential	150	10.13	413	27.89	402	27.14	188	12.69	94	6.35	234	15.80



Total                      150                      413                      403                      190                      94                      239



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

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	1	1	2	1	1	1	0	0	1	1	133	96
Masonry	33	9	114	31	123	34	56	15	20	6	17	5
Steel	0	0	0	0	1	20	2	40	0	0	2	40
Wood	116	12	297	30	278	28	132	13	73	7	85	9

## Essential Facility Damage

Before the flood analyzed in this scenario, the region had 83 hospital beds available for use. On the day of the scenario flood event, the model estimates that 83 hospital beds are available in the region.

**Table 5: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use



Fire Stations	11	1	0	1
Hospitals	1	0	0	0
Police Stations	11	4	0	4
Schools	24	4	1	4

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

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

## Induced Flood Damage

### Debris Generation

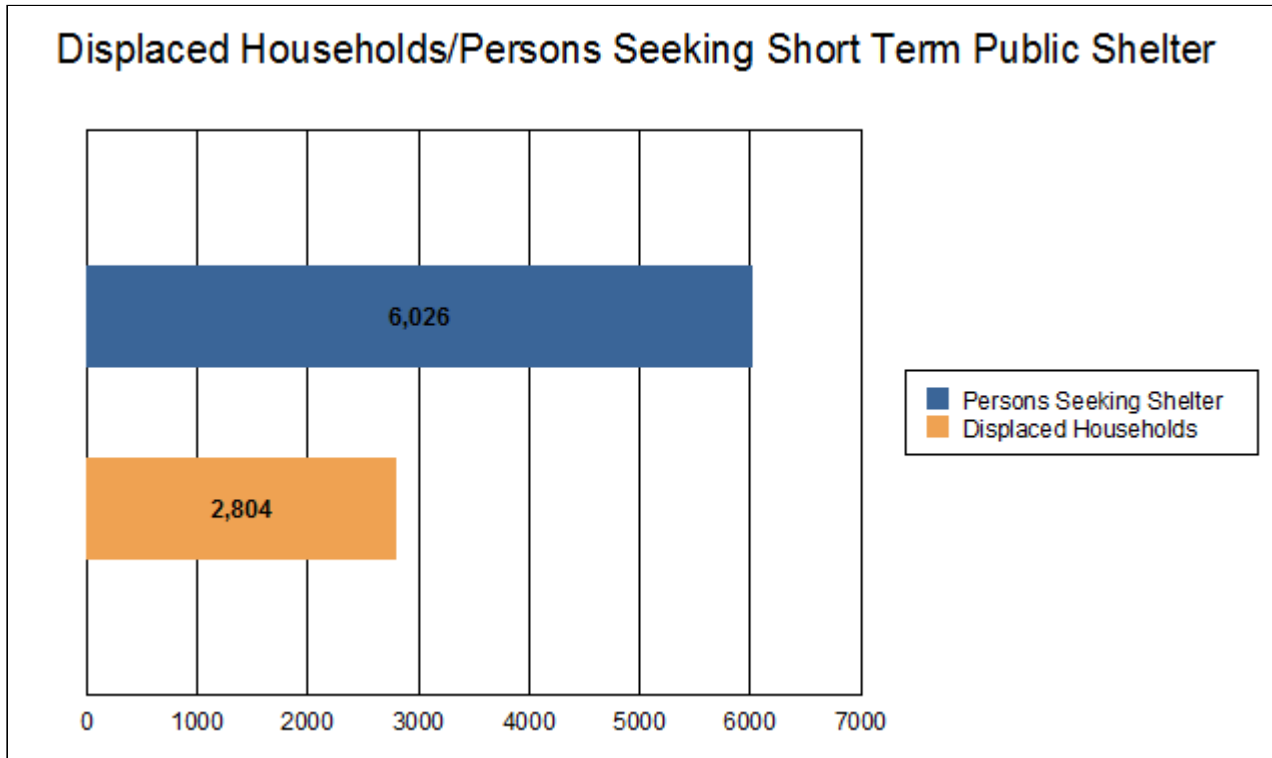
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because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

**Analysis has not been performed for this Scenario.**

## Social Impact

### Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 2,804 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 6,026 people (out of a total population of 41,981) will seek temporary shelter in public shelters.



## Economic Loss

The total economic loss estimated for the flood is 480.70 million dollars, which represents 23.02 % 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.

<b>238.63</b>	<b>238.63</b>	238.63
<small>238.63</small>		

The total building-related losses were 478.76 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 49.64% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

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

Category	Area	Residential	Commercial	Industrial	Others	Total
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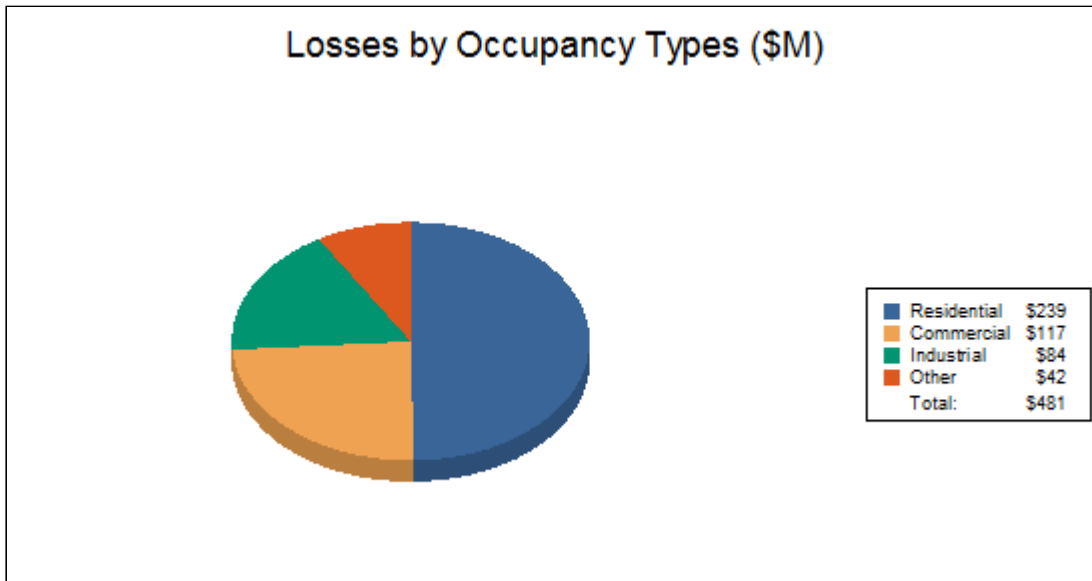
Building Loss

Building	159.80	32.41	22.94	7.80	222.94
Content	78.58	81.16	53.69	32.12	245.55
Inventory	0.00	2.82	6.86	0.59	10.27
<b>Subtotal</b>	<b>238.37</b>	<b>116.39</b>	<b>83.49</b>	<b>40.51</b>	<b>478.76</b>

Business Interruption

Income	0.01	0.27	0.01	0.08	0.37
Relocation	0.18	0.05	0.01	0.04	0.27
Rental Income	0.04	0.03	0.00	0.00	0.07
Wage	0.03	0.30	0.01	0.90	1.24
<b>Subtotal</b>	<b>0.25</b>	<b>0.65</b>	<b>0.03</b>	<b>1.02</b>	<b>1.94</b>

<u>ALL</u>	<b>Total</b>	<b>238.63</b>	<b>117.03</b>	<b>83.52</b>	<b>41.52</b>	<b>480.70</b>
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**Appendix A: County Listing for the Region**

Pennsylvania  
- Tioga

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

	Population	Building Value (thousands of dollars)		Total
		Residential	Non-Residential	
<b>Pennsylvania</b>				
Tioga	41,981	3,136,740	896,334	4,033,074
<b>Total</b>	<b>41,981</b>	<b>3,136,740</b>	<b>896,334</b>	<b>4,033,074</b>
<b>Total Study Region</b>	<b>41,981</b>	<b>3,136,740</b>	<b>896,334</b>	<b>4,033,074</b>