

5.4.5 EARTHQUAKE

This section provides a profile and vulnerability assessment for the earthquake hazard.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or by a manmade explosion (Federal Emergency Management Agency [FEMA], 2010; Shedlock and Pakiser, 1997). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. New York State is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser, 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser, 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter (FEMA, 2011).

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches. A description of each of these is provided below.

- **Surface faulting**: Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground motion (shaking)**: The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslide**: A movement of surface material down a slope.
- **Liquefaction**: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
- **Tectonic Deformation**: A change in the original shape of a material due to stress and strain.
- **Tsunami**: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.

- Seiche: The sloshing of a closed body of water from earthquake shaking (USGS, 2012).

Extent

Seismic waves are the vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a measured value of the earthquake size, or amplitude of the seismic waves, using a seismograph. The Richter magnitude scale (Richter Scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes (USGS, 1989). The Richter Scale is the most widely-known scale that measures the magnitude of earthquakes (Shedlock and Pakiser, 1997; USGS, 2009). It has no upper limit and is not used to express damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude and shock in a remote area that did not cause any damage (USGS, 1989). Table 5.4.5-1 presents the Richter Scale magnitudes and corresponding earthquake effects.

Table 5.4.5-1. Richter Scale

Richter Magnitude	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: USGS, 2006

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and varies with location. Intensity is expressed by the Modified Mercalli Scale; a subjective measure that describes how strong a shock was felt at a particular location (Shedlock and Pakiser, 1997; USGS, 2004). The Modified Mercalli Scale expresses the intensity of an earthquake’s effects in a given locality in values ranging from I to XII. Table 5.4.5-2 summarizes earthquake intensity as expressed by the Modified Mercalli Scale. Table 5.4.5-3 displays the Modified Mercalli Scale and peak ground acceleration equivalent.

Table 5.4.5-2. Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Felt by very few people; barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, some people awakened. Small objects moves, trees and poles may shake.
VI	Felt by everyone; people have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.
VIII	Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Some walls collapse.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Mercalli Intensity	Description
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source(s): Michigan Tech University, 2007; Nevada Seismological Laboratory, 1996

Table 5.4.5-3. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy

Source: NYSDPC, 2011

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). USGS defines PGA and SA as the following: ‘PGA is what is experienced by a particle on the ground. Spectral Acceleration (SA) is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building’ (USGS, 2009). Both PGA and SA can be measured in *g* (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). PGA and SA hazard maps provide insight into location specific vulnerabilities (NYSDPC, 2011).

PGA is a common earthquake measurement that shows three things: the geographic area affected, the probability of an earthquake of each given level of severity, and the strength of ground movement (severity) expressed in terms of percent of acceleration force of gravity (%g). In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area (NYSDPC, 2011).

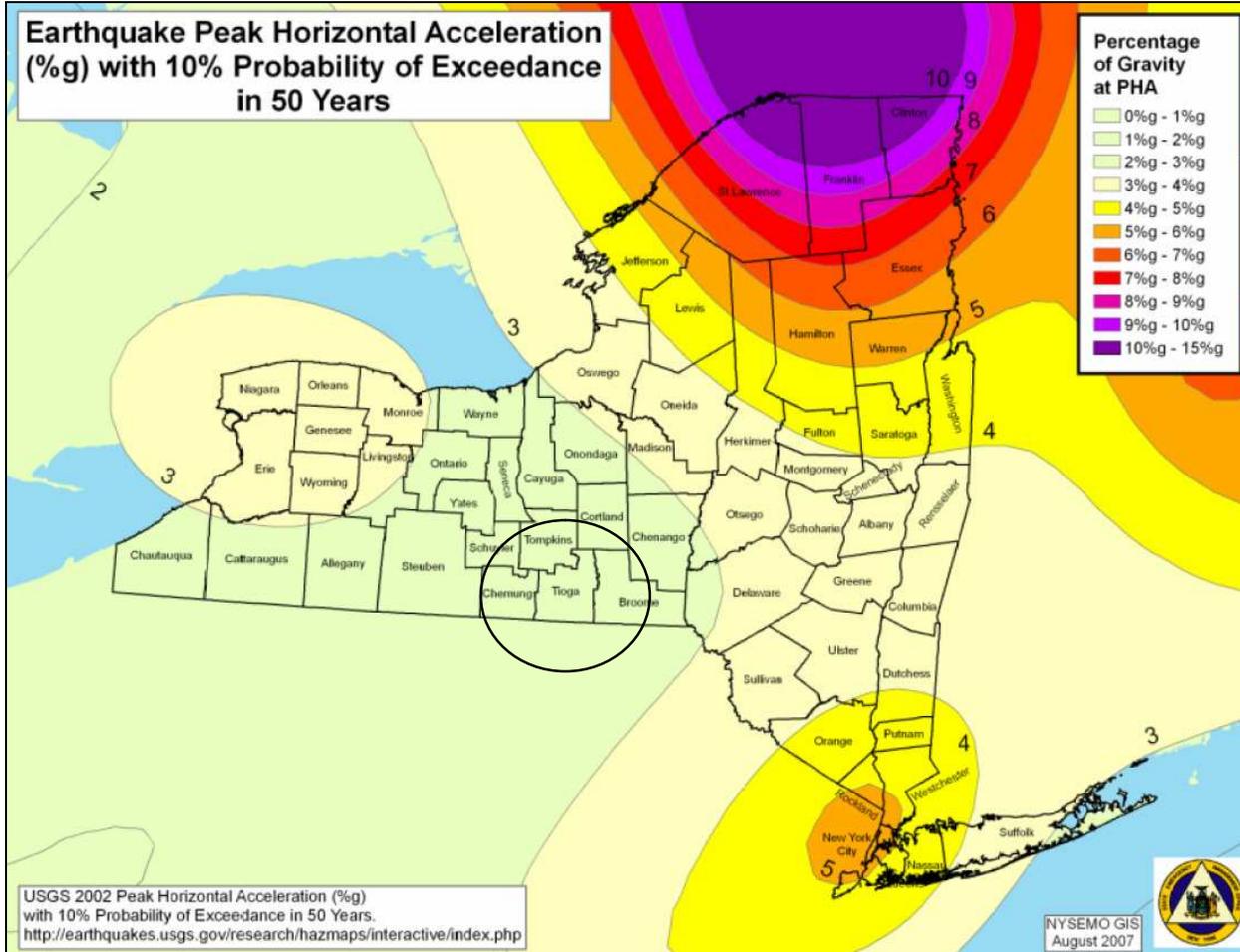
National maps of earthquake shaking hazards have been produced since 1948. They provide information essential to creating and updating the seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning used in the U.S. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damages and disruption. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown et al., 2001).

The USGS recently updated the National Seismic Hazard Maps in 2008 which superceded the 2002 maps. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

incorporated into these revised maps. The 2008 map represents the best available data as determined by the USGS (USGS, 2012).

Figure 5.4.5-1. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years (2002)

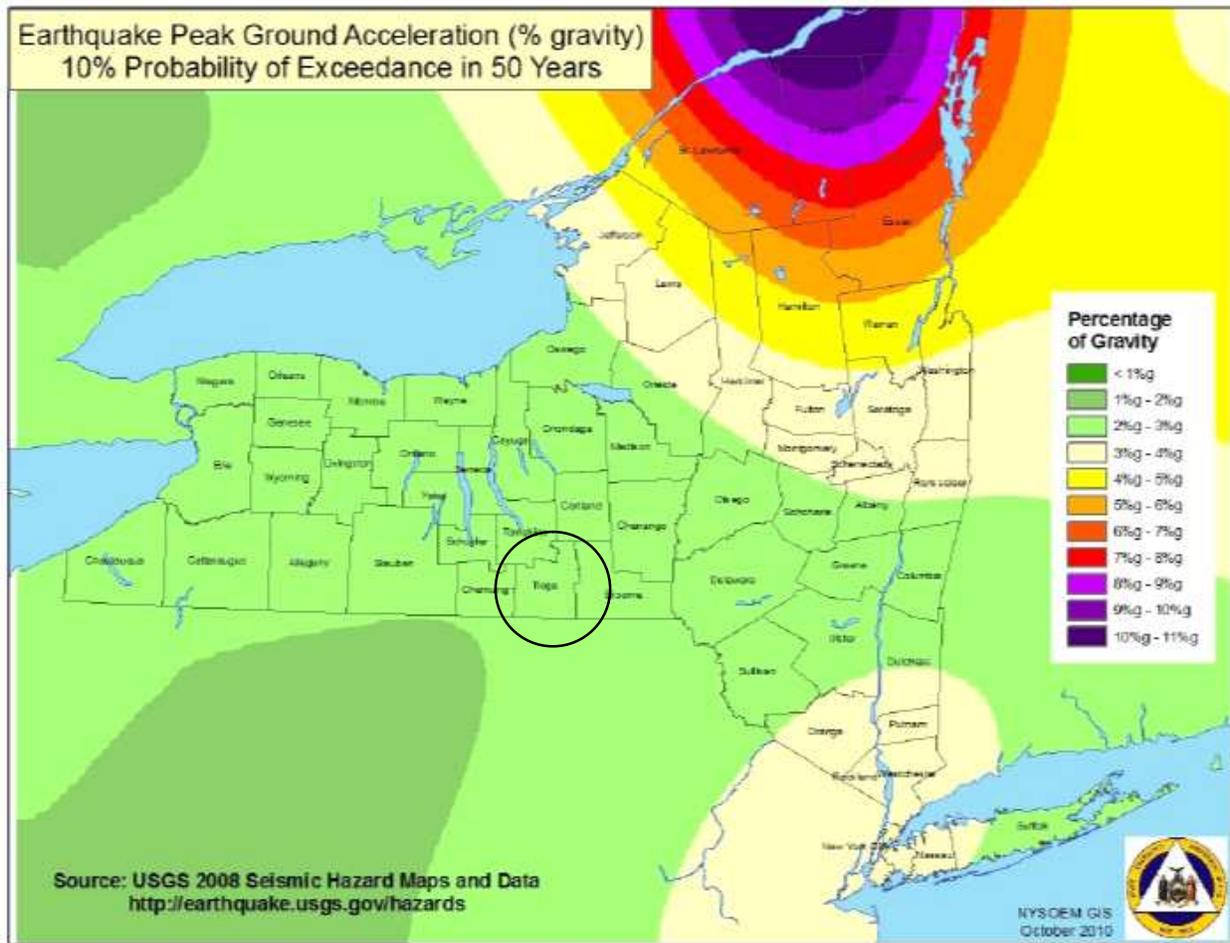


Source: NYSDPC, 2011

Note: The black circle indicates the approximate location of Tioga County.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Figure 5.4.5-2. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years (2008)



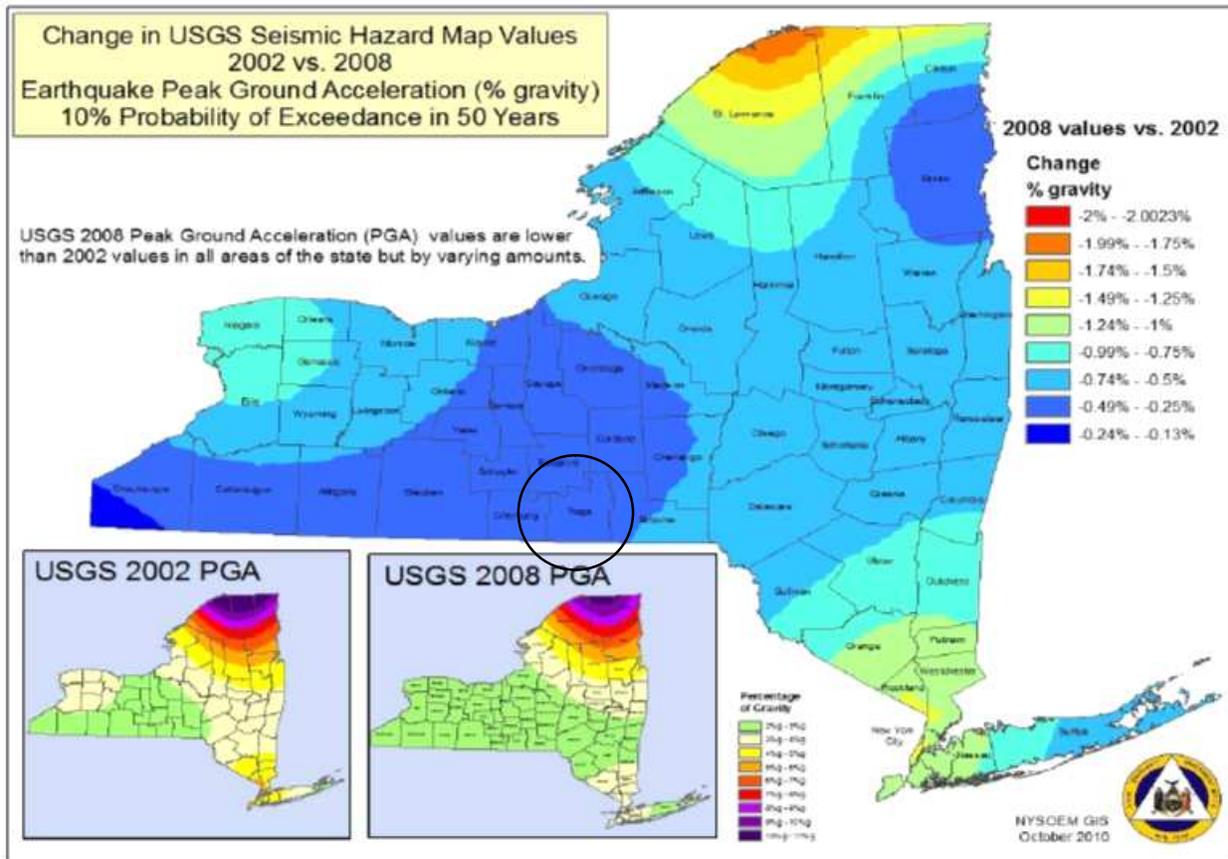
Source: NYSDPC, 2011

Note: The black circle indicates the approximate location of Tioga County.

The 2002 Seismic Hazard Map shows that Tioga County has a PGA between 2 and 3% (Figure 5.4.5-1). The 2008 Seismic Hazard Map shows that Tioga County has a PGA between 2 and 3% (Figure 5.4.5-2). These maps are based on peak ground acceleration (%g) with 10% probability of exceedance in 50 years. Figure 5.4.5-3 illustrates the change between the 2002 and 2008 USGS Seismic Hazard Maps. Tioga County had a 0.25 and 0.49% change in PGA.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Figure 5.4.5-3. Change Between USGS 2002 and 2008 Seismic Hazard Maps

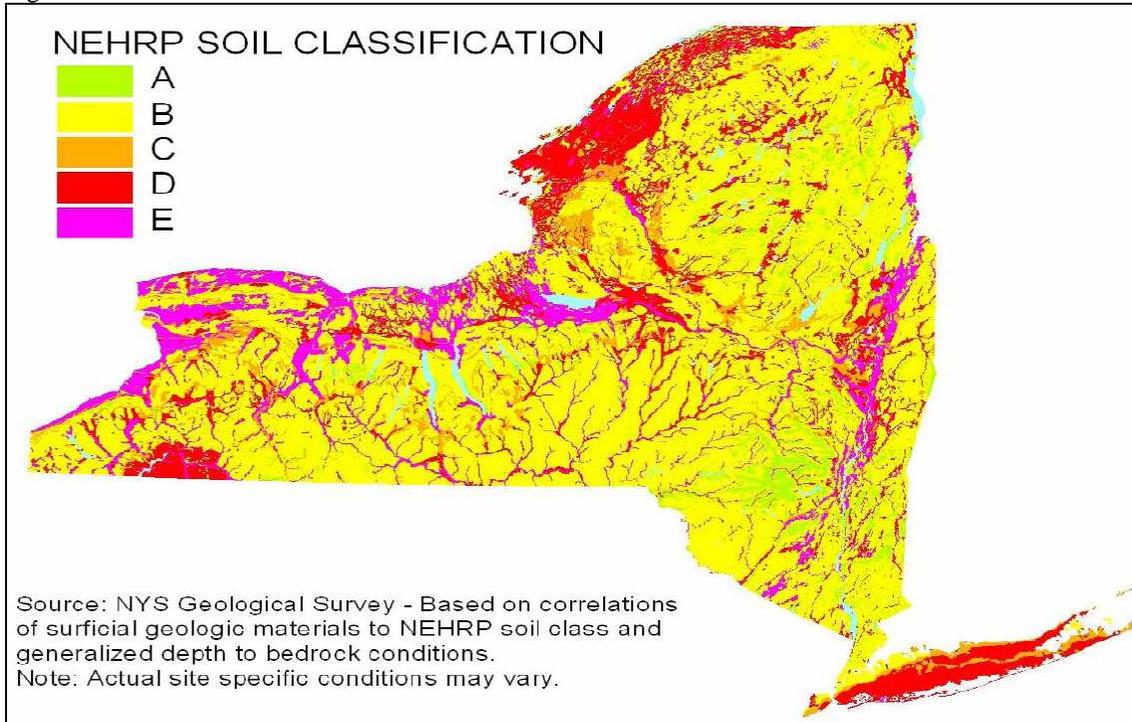


Source: NYSDPC, 2011

Note: The black circle indicates the approximate location of Tioga County.

The New York State Geological Survey conducted seismic shear-wave tests of the State’s surficial geology (glacial deposits). Based on these test results, the surficial geologic materials of New York State were categorized according to the National Earthquake Hazard Reduction Program’s (NEHRP) Soil Site Classifications (Figure 5.4.5-X). The NEHRP developed five soil classifications that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Figure 5.4.5-5 illustrates the NEHRP soil classifications in Tioga County, as provided by NYSEMO (O’Brien, 2008). Table 5.4.5-4 summarizes the NEHRP soil classifications shown on Figure 5.4.5-4.

Figure 5.4.5-4. NEHRP Soils in New York



Source: NYSDPC, 2011

As illustrated in Figure 5.4.5-5, Tioga County is mainly comprised of NEHRP soil classes A through E. The majority of the County is soil class X; however, classes X through X are located along riverine reaches.

Figure 5.4.5-5. NEHRP Soils in Tioga County

Source: O'Brien, 2008

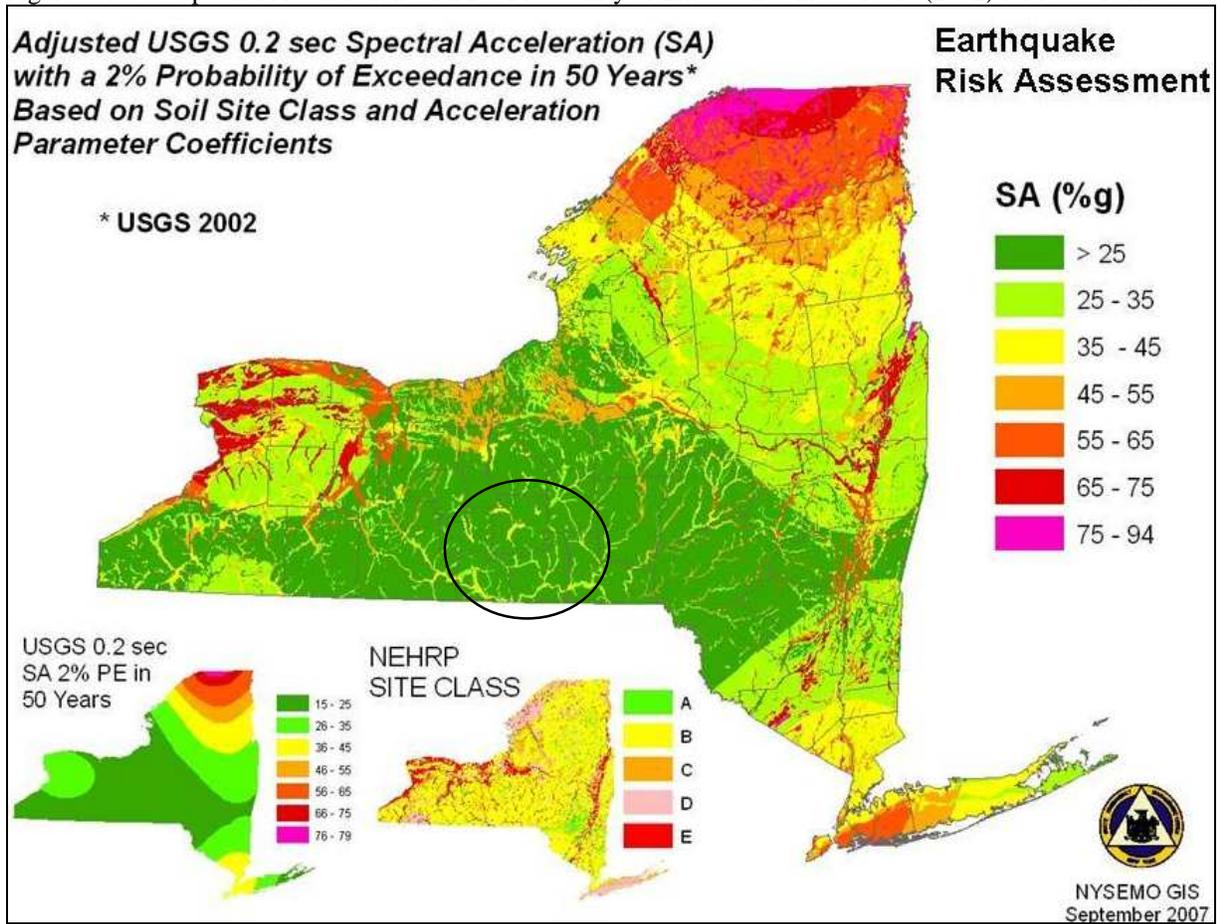
Table 5.4.5-4. NEHRP Soil Classifications

Soil Classification	Description
A	Very hard rock (e.g., granite, gneisses)
B	Sedimentary rock or firm ground
C	Stiff clay
D	Soft to medium clays or sands
E	Soft soil including fill, loose sand, waterfront, lake bed clays

Source: NYSDPC, 2011

The NEHRP soil classification for the State has enabled the affect of soils to be factored with the 2002 USGS seismic hazard maps. Figures 5.4.5-6 and 5.4.5-7 now illustrate the State and County’s earthquake SA hazard with local soil types factored in, respectively. This updated hazard map illustrates a higher hazard for Tioga County than what is shown on the USGS national map (NYSDPC, 2011).

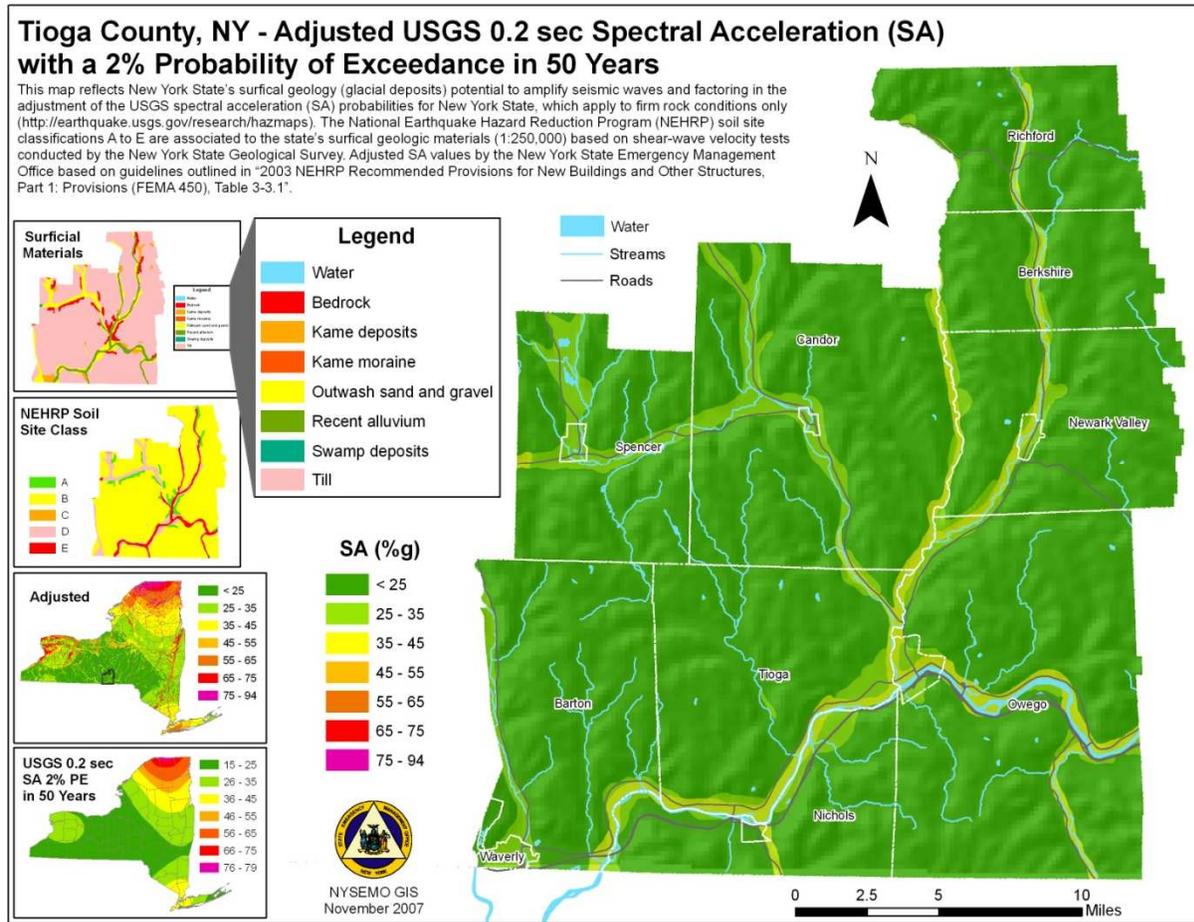
Figure 5.4.5-6. Spectral Acceleration with 2% Probability of Exceedance in 50 Years (2002) for New York State



Source: NYSDPC, 2011

Note: The black circle indicates the approximate location of Tioga County.

Figure 5.4.5-7. Spectral Acceleration with 2% Probability of Exceedance in 50 Years (2002) for Tioga County

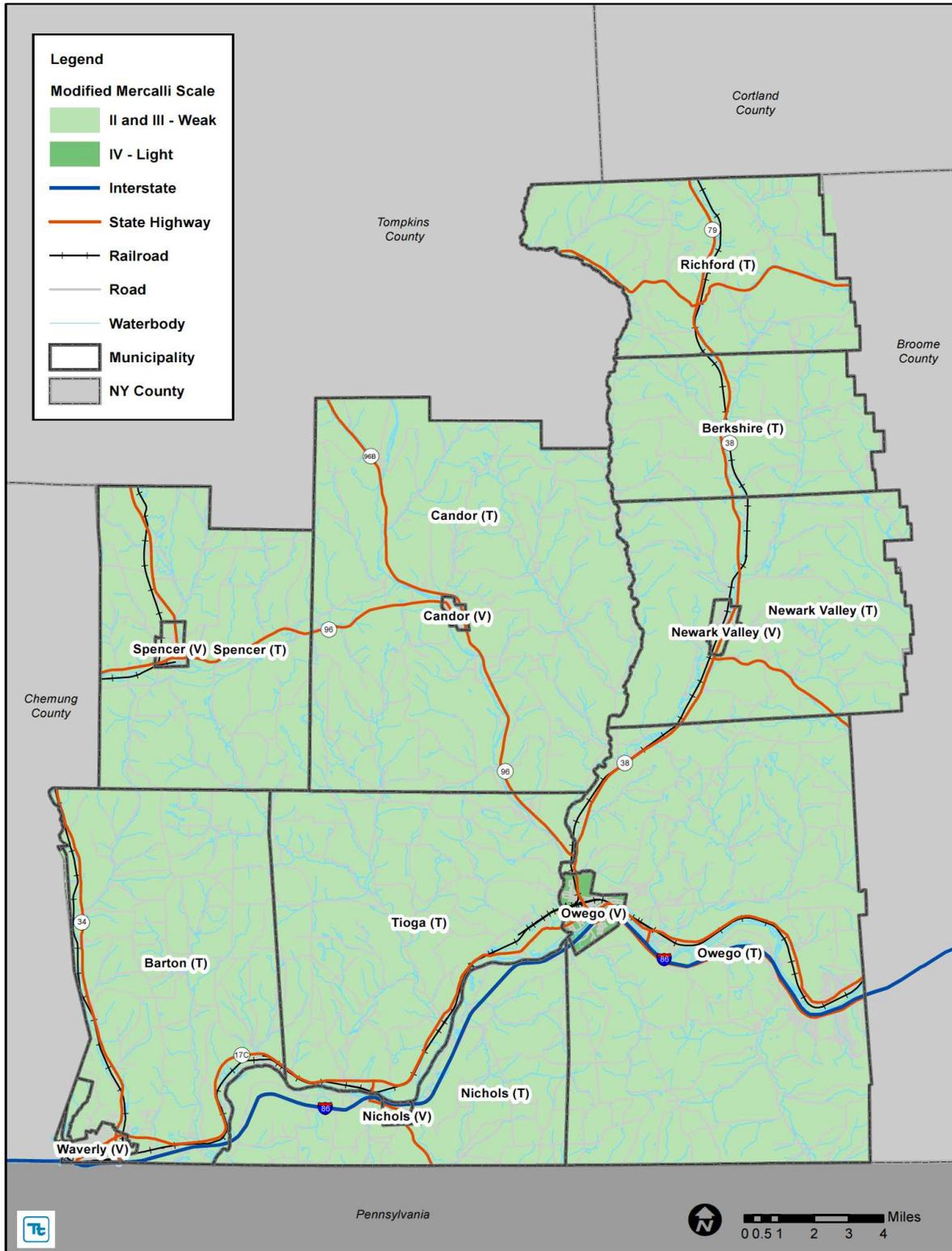


Source: NYSDPC, 2011

A probabilistic assessment was conducted for the 100-, 500- and 2,500-year mean return periods (MRP) through a Level 1 analysis in HAZUS-MH 2.0 to analyze the earthquake hazard for Tioga County. The HAZUS analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. A 100-year MRP event is an earthquake with a 1% chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 500-year MRP, there is a 0.2% chance the mapped PGA will be exceeded in any given year. For a 2,500-year MRP, there is a 0.04% chance the mapped PGA will be exceeded in any given year. Figures 5.4.5-8 through 5.4.5-10 illustrates the geographic distribution of PGA (g) across Tioga County or 100-, 500- and 2,500-year MRP events at the Census-Tract level.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Figure 5.4.5-8. Peak Ground Acceleration Modified Mercalli Scale in Tioga County for a 100-Year MRP Earthquake Event

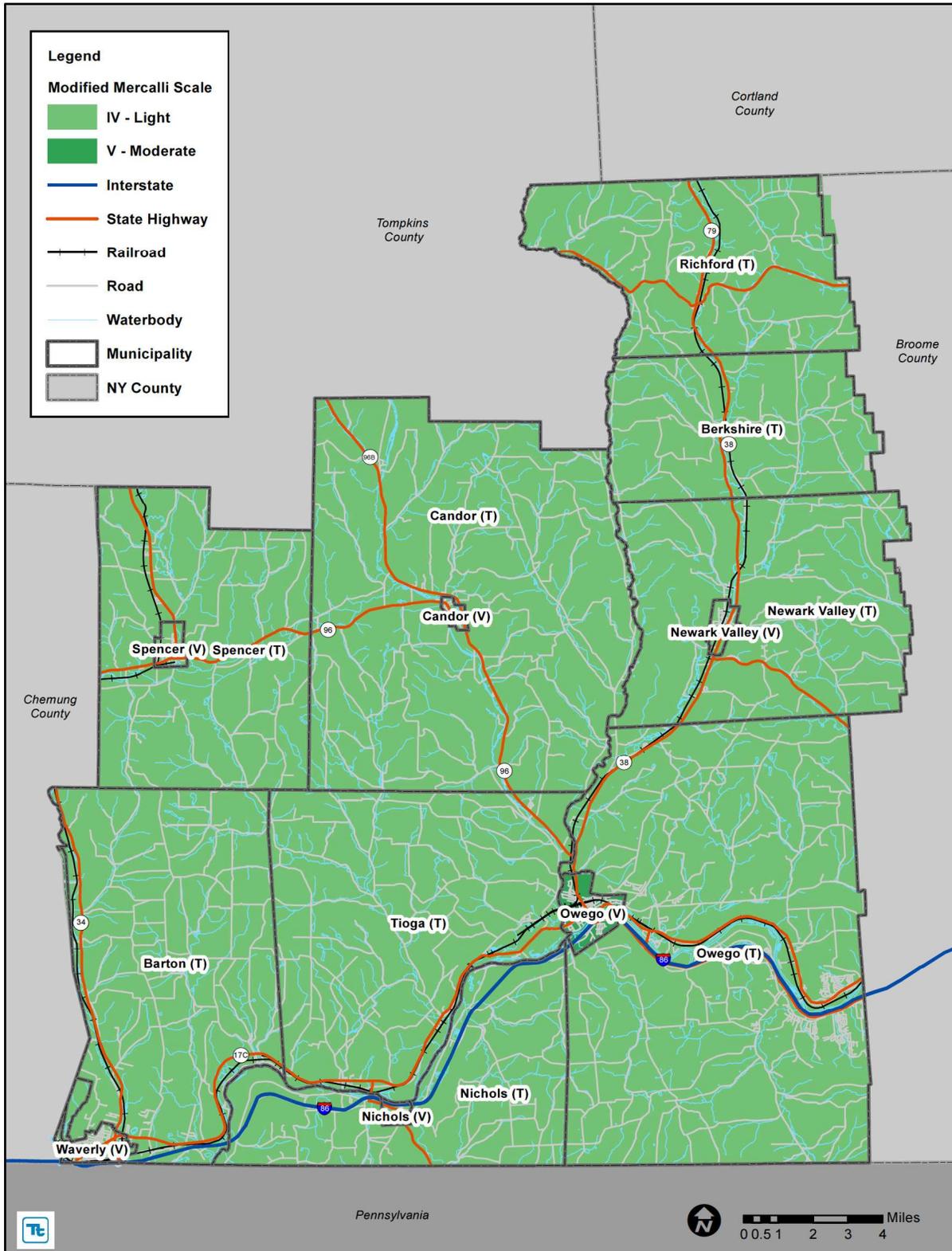


Source: HAZUS 2.0

Note: The peak ground acceleration for the 100-year MRP is 0.64 to 1.75%g.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Figure 5.4.5-9. Peak Ground Acceleration Modified Mercalli Scale in Tioga County for a 500-Year MRP Earthquake Event



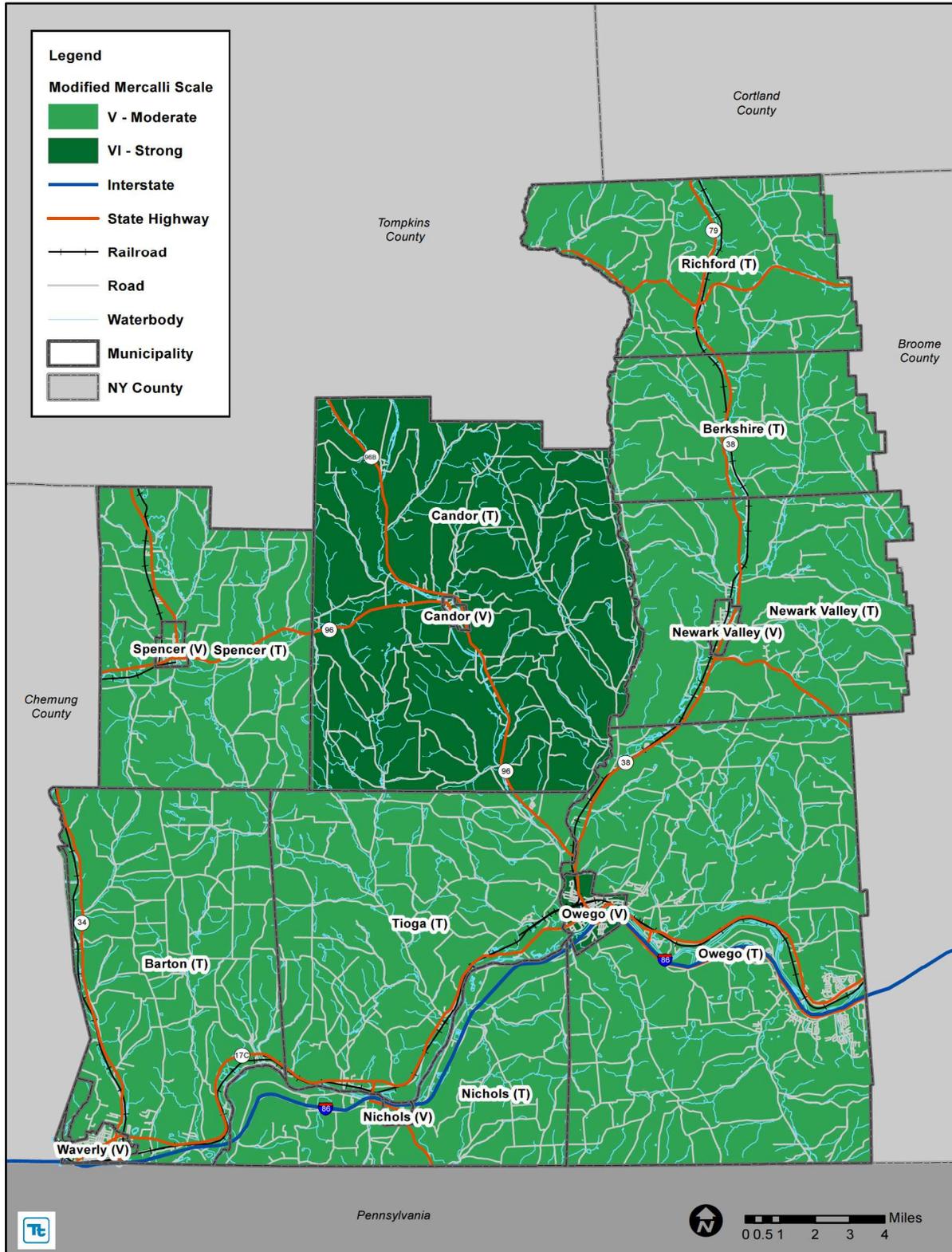
Source: HAZUS 2.0

Note: The peak ground acceleration for the 500-year MRP is 1.84 to 5.75%g.



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Figure 5.4.5-10. Peak Ground Acceleration Modified Mercalli Scale in Tioga County for a 2,500-Year MRP Earthquake Event



Source: HAZUS 2.0

Note: The peak ground acceleration for the 2,500-year MRP is 4.72 to 14.5%g.



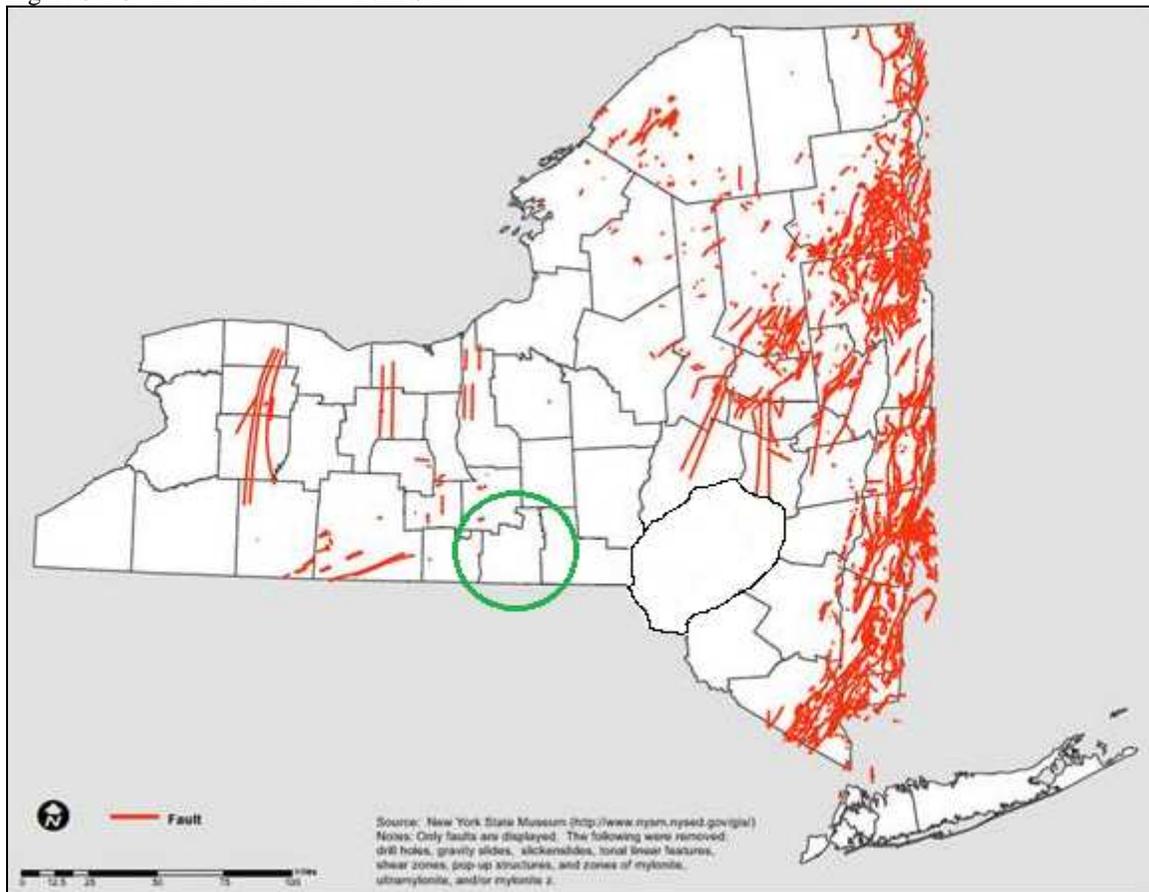
Location

As noted in the NYS HMP, the importance of the earthquake hazard in New York State is often underestimated because other natural hazards (for example, hurricanes and floods) occur more frequently and because major floods and hurricanes have occurred more recently than a major earthquake event (NYSDPC, 2011). Typically areas east of the Rocky Mountains experience fewer and generally smaller earthquakes than the western U.S. However, the potential for earthquakes exists across all of New York State and the entire northeastern U.S. The New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) ranks New York State as having the third highest earthquake activity level east of the Mississippi River (Tantala et al., 2003).

The closest plate boundary to the East Coast is the Mid-Atlantic Ridge, which is approximately 2,000 miles east of Pennsylvania. Over 200 million years ago, when the continent Pangaea rifted apart forming the Atlantic Ocean, the Northeast coast of America was a plate boundary. Being at the plate boundary, many faults were formed in the region. Although these faults are geologically old and are contained in a passive margin, they act as pre-existing planes of weakness and concentrated strain. When a strain exceeds the strength of the ancient fault, it ruptures causing an earthquake (Lehigh Earth Observatory, 2006).

There are numerous faults throughout New York State. Figure 5.4.5-11 illustrates the faults relative to Tioga County (NYS Museum, 2012).

Figure 5.4.5-11. Faults in New York State

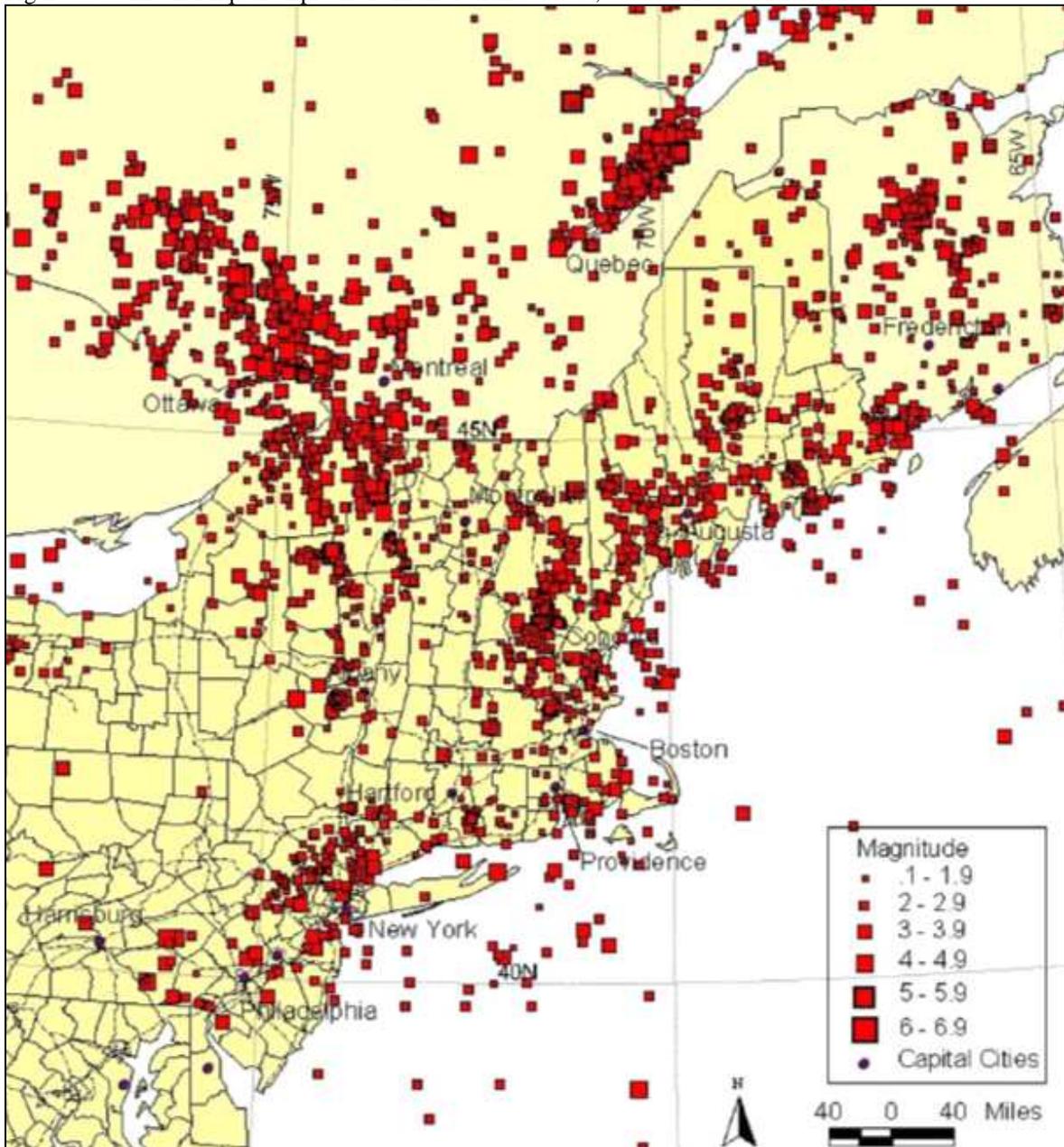


Source: NYS Museum, 2012

There are three general regions in New York State that have a higher seismic risk compared to other parts of the State. These regions are: 1) the north and northeast third of the State, which includes the North Country/Adirondack region and a portion of the greater Albany-Saratoga region; 2) the southeast corner, which includes the greater New York City area and western Long Island; and 3) the northwest corner, which includes Buffalo and its surrounding area. Overall, these three regions are the most seismically active areas of the State, with the north-northeast portion having the higher seismic risk and the northwest corner of the State has the lower seismic risk (NYS DPC, 2011).

Figure 5.4.5-12 illustrates historic earthquake epicenters across the northeast U.S. and New York State between October 1975 and March 2010. There have been multiple earthquakes originating outside New York's borders that have been felt within the State. These quakes have come from Quebec, Canada and Massachusetts. According to the NYS HMP, such events are considered significant for hazard mitigation planning because they could produce damage within the State in certain situations.

Figure 5.4.5-12. Earthquake Epicenters in the Northeast U.S., October 1975 to March 2010



Source: NYSDPC, 2011

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with earthquakes throughout New York State. Therefore, with so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the sources.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

According to the NYSDPC, USGS, NEIC and Lamont-Doherty, approximately 35 earthquake events have affected New York State between 1971 and 2011. Additional sources have noted other earthquake events within New York State as well. Table 5.4.5-5 depicts these earthquakes events. Several of these events were located within the vicinity of Tioga County.

Table 5.4.5-5. Earthquake History in New York State, 1950-2012

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
May 23, 1971	Earthquake 3.5 – 4.1	Blue Mountain Lake	N/A	N/A	No reference and/or no damage reported.	NYSDPC
June 7, 1974	Earthquake 3.0	Wappinger Falls	N/A	N/A	Earthquake caused windows to break and a bookcase to topple. More than 100 aftershocks were reported through June 13 th .	NYSDPC, Stover and Coffman
June 9, 1975	Earthquake 3.5	Plattsburgh (Altona)	N/A	N/A	In Beekmantown on Lake Champlain, a chimney and fireplace were cracked. East of Beekmantown, in Fairfax, Vermont, slight damage was reported.	NYSDPC, Stover and Coffman
November 3, 1975	Earthquake 4.0	Raquette Lake	N/A	N/A	No reference and/or no damage reported.	NYSDPC
March 10, 1979	Earthquake 3.2	N/A	N/A	N/A	Felt by some in Manhattan	Kim
February 2, 1983	Earthquake 3.0	Scarsdale-Lagrangeville	N/A	N/A	Chimneys cracked	NYSDPC
October 7, 1983	Earthquake 5.1	Goodnow, Adirondack Mountains	N/A	N/A	An old chimney collapsed, about 20 tombstones slid or rotated, and some minor cracks formed in plaster walls in Blue Mountain Lake. Several landslides were reported. Light damage was reported in surrounding towns. It was felt over a wide range, including two provinces in Canada and 12 states.	NYSDPC, Stover and Coffman
October 19, 1985	Earthquake 4.0	Ardsley	N/A	N/A	Windows broken in Newburgh, New York and Glenville, Connecticut. Plaster and drywall were cracked and glassware broke in Newburgh. Light damage was sustained in some towns in Connecticut, New Jersey and New York. It was felt over a large area of Connecticut, Massachusetts, New Jersey, New York and Pennsylvania. A moderate aftershock was felt on October 21 st in Connecticut, New York and New Jersey.	NYSDPC, Stover and Coffman, Kim

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
June 17, 1991	Earthquake 4.1	Richmondville	N/A	N/A	No reference and/or no damage reported.	NYSDPC
March 10, 1992	Earthquake 2.8	East Hampton, Suffolk County	N/A	N/A	Very minor damage to the area. The earthquake was centered in the Atlantic Ocean, about 15 miles south of Montauk. It was felt from the tip of eastern Long Island to New London, Connecticut.	NYSDPC
March 22, 1994	Earthquake 3.6	N/A	N/A	N/A	No reference and/or no damage reported	NYSDPC
Earthquake April 20, 2000	Earthquake 3.8	Newcomb	N/A	N/A	No reference and/or no damage reported	NYSDPC
November 6, 2000	Earthquake 2.4	Duanesburg	N/A	N/A	No reference and/or no damage reported.	NEIC
January 17, 2001	Earthquake 2.4	N/A	N/A	N/A	Felt in Upper East Side of Manhattan, Long Island city and Queens.	Kim
October 17, 2001	Earthquake 2.6	N/A	N/A	N/A	Felt in Upper West Side of Manhattan, Astoria and Queens	Kim
April 20, 2002	Earthquake 5.1	Au Sable Forks	DR-1415	No	Largest earthquake to hit New York State in 20 years. People felt the earthquake from Washington, D.C. to Bangor, Maine. A state of emergency was declared in Essex and Clinton Counties.	NYSDPC, USGS
May 24, 2002	Earthquake 3.1	Au Sable Forks	N/A	N/A	Aftershock of the April 20 th event; no damage reported.	NYSDPC, USGS
March 26, 2007	Earthquake 1.8	Feura Bush	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
April 11, 2007	Earthquake 2.6	Wolcott	N/A	N/A	No reference and/or no damage reported.	USGS
July 19, 2007	Earthquake 3.0	Lake Ontario	N/A	N/A	No reference and/or no damage reported.	USGS



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
July 24, 2007	Earthquake 2.6 – 3.1	Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 27, 2008	Earthquake 2.7	Howes Cave	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
May 28, 2008	Earthquake 1.8	Saratoga Springs	N/A	N/A	No reference and/or no damage reported.	USGS
February 18, 2009	Earthquake 2.3 – 2.7	East Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 20, 2009	Earthquake 2.7	East Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 23, 2009	Earthquake 2.1	East Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
March 22, 2009	Earthquake 2.1 - 2.8	Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
May 18, 2009	Earthquake 2.1 - 3.0	Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
October 21, 2009	Earthquake 2.9	East Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
December 13, 2009	Earthquake 2.6 – 3.1	Berne	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
February 15, 2010	Earthquake 2.2	Berne	N/A	N/A	No reference and/or no damage reported.	NEIC
February 18, 2010	Earthquake 2.7	Berne	N/A	N/A	No reference and/or no damage reported.	NEIC



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
March 24, 2010	Earthquake 2.7	Berne	N/A	N/A	No reference and/or no damage reported.	NEIC
August 25, 2011	Earthquake 2.0 – 2.8	Altamont	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
August 26, 2011	Earthquake 2.2	Altamont	N/A	N/A	No reference and/or no damage reported.	NEIC
August 27, 2011	Earthquake 2.9	Altamont	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC
November 21, 2011	Earthquake 2.4	Moira	N/A	N/A	No reference and/or no damage reported.	USGS, NEIC

Source(s): NYSDPC, 2011; NEIC, 2011; USGS, 2011; Kim, 1999; Stover and Coffman, 1989

DR Disaster Declaration
 FEMA Federal Emergency Management Agency
 N/A Not Applicable/Not available
 NEIC National Earthquake Information Center
 NYSDPC New York State Disaster Preparedness Commission
 USGS U.S. Geological Survey



Earthquakes in Tioga County are not common, with documented information on earthquake events and their location is being relatively scarce. According to Planning Area officials, there is no record of earthquake occurrences within the Planning Area. However, depending on the magnitude, the impacts of earthquake events can be far-reaching; therefore, reported incidences within the surrounding counties or states could have created indirect impacts upon the Planning Area. The following events described below may or may not have created indirect impacts upon Tioga County.

Probability of Future Events

Earthquake hazard maps illustrate the distribution of earthquake shaking levels that have a certain probability of occurring over a given time period. According to the USGS, in 2008, Tioga County had a PGA of 2-3%g for earthquakes with a 10-percent probability of occurring within 50 years.

The NYSDPC indicates that the earthquake hazard in New York State is often understated because other natural hazards occur more frequently (for example: hurricanes, tornadoes and flooding) and are much more visible. However, the potential for earthquakes does exist across the entire northeastern U.S., and New York State is no exception (NYSDPC, 2011).

Earlier in this section, the identified hazards of concern for Tioga County were ranked. NYSOEM conducts a similar ranking process for hazards that affect the State. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for earthquakes in the County is considered “occasional” (likely to occur within 100 years as presented in Table 5.3-3). Although no reported incidences have occurred within Tioga County, it is anticipated that the County will experience indirect impacts from earthquakes that may affect the general building stock, local economy and may induce secondary hazards such ignite fires and cause utility failure.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the earthquake hazard, all of Tioga County has been identified as the exposed hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are exposed and vulnerable to direct and indirect impacts of earthquakes. The following section includes an evaluation and estimation of the potential impact of the earthquake hazard on Tioga County including the following:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin. The extent of damage depends on the density of population and building and infrastructure construction in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, the age of the buildings and building codes in place. Compounding the potential for damage – historically, Building Officials Code Administration (BOCA) used in the Northeast were developed to address local concerns including heavy snow loads and wind; seismic requirements for design criteria are not as stringent compared to the west coast’s reliance on the more seismically-focused Uniform Building Code). As such, a smaller earthquake in the Northeast can cause more structural damage than if it occurred out west.

In summary, the entire population and general building stock inventory of Tioga County is at risk of being damaged or experiencing losses due to impacts of an earthquake. The impacts on population, existing structures, critical facilities and the economy within the County and participating municipalities are presented below for three probabilistic earthquake events, the 100-year, 500- and 2,500-year mean return periods (MRP), in addition to annualized losses; following a summary of the data and methodology used.

Data and Methodology

A probabilistic assessment was conducted for Tioga County for the 100-, 500- and 2,500-year MRPs through a Level 2 analysis in HAZUS-MH 2.0 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract. According to NYCEM, probabilistic estimates are best for urban planning, land use, zoning and seismic building code regulations (NYCEM, 2003). The default assumption is a magnitude 7 earthquake for all return periods.

A detailed soil map with NEHRP soil classifications in Tioga County, as provided by NYSOEM, was supplied to the HAZUS-MH earthquake model. HAZUS-MH amplifies the ground motion demand based on the soil classification for each Census Tract. As discussed earlier, Tioga County is comprised of soil classes A, B, C, D, and E. According to NYCEM, softer soils (NEHRP soils D and E) can amplify ground

shaking to damaging levels even in a moderate earthquake (NYCEM, 2003). Therefore, these areas in Tioga County are most vulnerable to the earthquake hazard (see Figure 5.4.5-X).

Please note that the HAZUS earthquake model output is on a Census-tract level. Using the detailed NEHRP soil map, HAZUS assigned an NEHRP soil type to each Census tract.

In addition to the probabilistic scenarios mentioned, an annualized loss run was conducted in HAZUS 2.0 to estimate the annualized general building stock dollar losses for Tioga County. The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods: 100, 250, 500, 750, 1000, 1500, 2000, 2500-year, which are based on values from the USGS seismic probabilistic curves. The aggregation of these losses and exceedance probabilities are then annualized, providing, in essence, the estimated cost of earthquakes to the study region (Draft NYS HMP, 2011).

As noted in the HAZUS-MH Earthquake User Manual ‘Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainty in loss estimates produced by the HAZUS Earthquake Model, possibly at best a factor of two or more.’ However, HAZUS’s potential loss estimates are acceptable for the purposes of this HMP.

Impact on Life, Health and Safety

The entire population of Tioga County (53,954 people – 2010 Census) is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of buildings and the soil type buildings are constructed on. The impact of earthquakes on life, health and safety is dependent upon the severity of the event. Risk to public safety and loss of life from an earthquake in the County is minimal with higher risk occurring in buildings as a result of damage to the structure, or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the quake. Business interruption may prevent people from working, road closures could isolate populations and loss of functions of utilities could impact populations that may not have suffered direct damage from the event itself.

Populations considered most vulnerable include the elderly (persons over the age of 65) and individuals living below the Census poverty threshold. These socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing.

Residents may be displaced or require temporary to long-term sheltering due to the event. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. Tables 5.4.5-6 and 5.4.5-7 summarize the population HAZUS-MH 2.0 estimates will be displaced or will require short-term sheltering as a result of the 100-, 500- and 2,500-year MRP earthquake events.

Table 5.4.5-6. Summary of Estimated Sheltering Needs for Tioga County

Scenario	Displaced Households	People Requiring Short-Term Shelter
100-Year Earthquake	0	0
500-Year Earthquake	3	2

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Scenario	Displaced Households	People Requiring Short-Term Shelter
2,500-Year Earthquake	30	24

Source: HAZUS-MH 2.0

Table 5.4.5-7. Estimated Sheltering Needs by Municipality for Tioga County

Municipality	500-Year		2,500-Year	
	Number of Displaced Households	People Requiring Short-Term Shelter	Number of Displaced Households	People Requiring Short-Term Shelter
Barton (T)	0	0	0	0
Berkshire (T)	0	0	0	0
Newark Valley (T)				
Newark Valley (V)				
Richford (T)				
Candor (T)	0	0	3	2
Candor (V)				
Nichols (T)	2	1	2	1
Nichols (V)				
Tioga (T)				
Owego (T)	0	0	2	1
Owego (V)	0	0	21	13
Spencer (T)	0	0	0	0
Spencer (V)				
Waverly (V)	1	1	2	7
Tioga County	3	2	30	24

Source: HAZUS-MH 2.0

Notes: The HAZUS-MH earthquake model results are reported by Census Tract. In some cases, there is more than one municipality per Census Tract.

According to the 1999-2003 New York City Area Consortium for Earthquake Loss Mitigation (NYSCEM) Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), there is a strong correlation between structural building damage and the number of injuries and casualties from an earthquake event. HAZUS-MH 2.0 estimates the number of people that may potentially be injured and/or killed by an earthquake depending upon the time of day the event occurs. These estimates are provided for three times of day (2:00am, 2:00pm and 5:00pm), representing the periods of the day that different sectors of the community are at their peak. The 2:00am estimate considers the residential occupancy at its maximum, the 2:00pm estimate considers the educational, commercial and industrial sector at their maximum and the 5:00pm estimate represents peak commuter time.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

No injuries or casualties are estimated for the 100-year event. Tables 5.4.5-8 and 5.4.5-9 summarize the injuries and casualties estimated for the 500-year and 2,500-year MRP earthquake events.

Table 5.4.5-8. Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	2	1	1
Hospitalization	0	0	0
Casualties	0	0	0

Source: HAZUS-MH 2.0

Table 5.4.5-9. Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	10	9	8
Hospitalization	2	1	1
Casualties	0	0	0

Source: HAZUS-MH 2.0

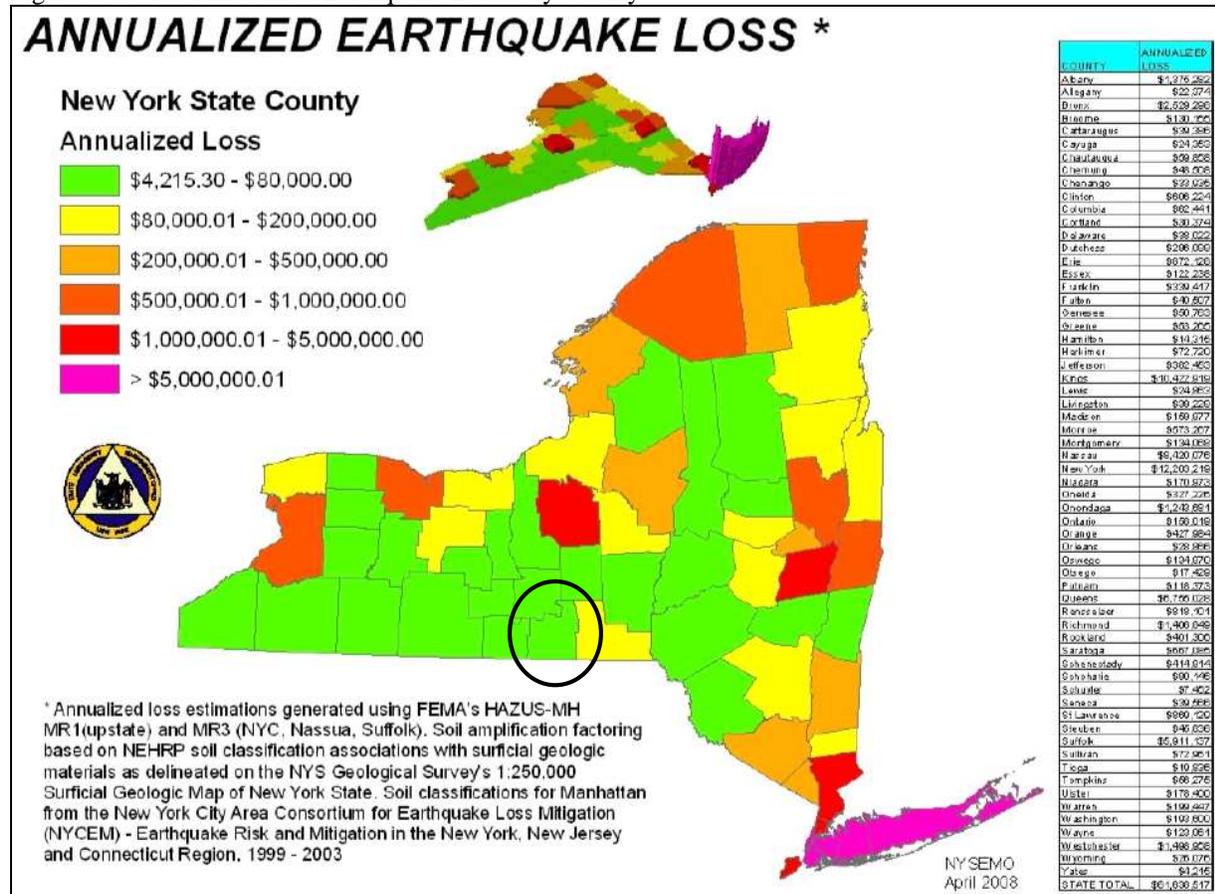
Earthquakes can cause secondary hazard events such as fires. No fires are anticipated as a result of the 100-, 500- and 2,500-year events.

Impact on General Building Stock

After considering the population exposed to the earthquake hazard, the value of general building stock exposed to and damaged by 100-, 500- and 2,500-year MRP earthquake events was evaluated. In addition, annualized losses were calculated using HAZUS 2.0. The entire study area’s general building stock is considered at risk and exposed to this hazard. The HAZUS 2.0 model estimates the value of the exposed building stock and the loss (in terms of damage to the exposed stock). Refer to Table 4-X in the County Profile (Section 4) for general building stock data replacement value statistics (structure and contents).

The NYS HMP conducted a HAZUS vulnerability assessment and reports estimates of earthquake losses factoring in NEHRP soil classes by County. For Tioga County, the estimated annualized earthquake loss is \$10,936 per year (Figure 5.4.5-13).

Figure 5.4.5-13. Annualized Earthquake Losses by County



Source: Draft NYS HMP, 2011

Note: The black circle indicates the approximate location of Tioga County

Using HAZUS 2.0, a probabilistic model was run for the purposes of this Plan to estimate annualized dollar losses for Tioga County, also factoring in NEHRP soil classes. Annualized losses are useful for mitigation planning because they provide a baseline upon which to 1) compare the risk of one hazard across multiple jurisdictions and 2) compare the degree of risk of all hazards for each participating jurisdiction. Please note that annualized loss does not predict what losses will occur in any particular year. The estimated annualized losses are approximately \$29,293 per year for the County (Table 5.4.5-10). These calculated losses are more than double the annualized loss estimation is in Figure 5.4.5-13 (\$10,936).

Table 5.4.5-10. Summary of Estimated Annualized Earthquake General Building Stock Losses for Tioga County

Municipality	Total (Buildings + Contents)	Buildings (Structural and Non-Structural)	Contents
Barton (T)	\$760	\$664	\$96
Berkshire (T)	\$507	\$455	\$52
Newark Valley (T)			
Newark Valley (V)			
Richford (T)	\$3,641	\$3,155	\$486
Candor (T)			

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Municipality	Total (Buildings + Contents)	Buildings (Structural and Non-Structural)	Contents
Candor (V)			
Nichols (T)			
Nichols (V)	\$1,238	\$1,092	\$146
Tioga (T)			
Owego (T)	\$3,199	\$2,763	\$436
Owego (V)	\$15,278	\$12,423	\$2,855
Spencer (T)			
Spencer (V)	\$513	\$452	\$61
Waverly (V)	\$4,157	\$3,448	\$709
Tioga County	\$29,293	\$24,452	\$4,841

Source: HAZUS-MH 2.0

Notes: The HAZUS-MH earthquake model results are reported by Census Tract. In some cases, there is more than one municipality per Census Tract.

According to the NYCEM, where earthquake risks and mitigation were evaluated in the New York, New Jersey and Connecticut region, most damage and loss caused by an earthquake is directly or indirectly the result of ground shaking (NYCEM, 2003). NYCEM indicates there is a strong correlation between PGA and the damage a building might experience. The HAZUS-MH 2.0 model is based on the best available earthquake science and aligns with these statements. HAZUS-MH 2.0 methodology and model were used to analyze the earthquake hazard for the general building stock for Tioga County. See Figures 5.4.5-X through 5.4.5-X earlier in this profile that illustrate the geographic distribution of PGA (g) across Tioga County for 100-, 500- and 2,500-year MRP events at the Census-Tract level.

According to NYCEM, a building’s construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that un-reinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake’s energy. Additional attributes that contribute to a building’s capability to withstand an earthquake’s force include its age, number of stories and quality of construction. HAZUS-MH considers building construction and the age of buildings as part of the analysis. Because the default general building stock was used for this HAZUS-MH analysis, the default building ages and building types already incorporated into the inventory were used.

Potential building damage was evaluated by HAZUS-MH 2.0 across the following damage categories (none, slight, moderate, extensive and complete). Table 5.4.5-11 provides definitions of these five categories of damage for a light wood-framed building; definitions for other building types are included in HAZUS-MH technical manual documentation. General building stock damage for these damage categories by occupancy class and building type on a County-wide basis is summarized for the 100-, 500- and 2,500-year events in Tables 5.4.5-12 through 5.4.5-14.

Table 5.4.5-11. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: HAZUS-MH Technical Manual

HAZUS-MH 2.0 estimates \$0 in building damage to Tioga County’s general building stock as a result of a 100-year MRP event.

Table 5.4.5-14 summarizes the damage estimated for the 500- and 2,500-year MRP earthquake events for each participating municipality by Census tract. Damage loss estimates include structural and non-structural damage to the building and loss of contents.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-12. Estimated Number of Buildings Damaged by General Occupancy for 100-year, 500-year and 2,500-year MRP Earthquake Events

Category	Average Damage State														
	100-Year MRP					500-Year MRP					2,500-Year MRP				
	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete
Residential	100%	0.0%	0.0%	0.0%	0.0%	98.2%	1.4%	0.4%	0.0%	0.0%	90.5%	6.7%	2.5%	0.3%	0.0%
Commercial	100%	0.0%	0.0%	0.0%	0.0%	96.9%	2.3%	0.8%	0.1%	0.0%	83.9%	9.3%	5.4%	1.2%	0.2%
Industrial	100%	0.0%	0.0%	0.0%	0.0%	97.6%	1.8%	0.6%	0.1%	0.0%	86.6%	8.0%	4.6%	0.9%	0.0%
Education, Government, Religious and Agricultural	100%	0.0%	0.0%	0.0%	0.0%	97.3%	2.0%	0.6%	0.1%	0.0%	86.0%	8.7%	4.5%	0.9%	0.0%

Source: HAZUS-MH 2.0

Note (1): Only the residential category contains building counts because the residential sub-categories RES1 (single-family dwellings) and RES2 (manufactured houses) building counts are based on census housing unit counts. All other occupancy class building counts are calculated in HAZUS-MH based on regional average square footage values for specific occupancy class/building types, and may significantly over- or under-estimate actual structure counts. Therefore, percent buildings damaged of the total region inventory are provided for all other occupancy classes in the table above.

Note (2): The percentages in the table above are based on the County’s building count in the HAZUS-MH earthquake model of 23,768 buildings.

Table 5.4.5-13. Estimated Number of Buildings Damaged by Building Type for 100-year, 500-year and 2,500-year MRP Earthquake Events

Category	Average Damage State														
	100-Year MRP					500-Year MRP					2,500-Year MRP				
	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete	None	Slight	Moderate	Extensive	Complete
Wood	100%	0.0%	0.0%	0.0%	0.0%	99.4%	0.6%	0.1%	0.0%	0.0%	94.6%	4.6%	0.7%	0.0%	0.0%
Steel	100%	0.0%	0.0%	0.0%	0.0%	97.6%	1.8%	0.6%	0.0%	0.0%	84.5%	8.4%	5.8%	1.2%	0.1%
Concrete	100%	0.0%	0.0%	0.0%	0.0%	97.5%	1.7%	0.5%	0.0%	0.0%	84.4%	8.9%	5.7%	1.0%	0.0%
Reinforced Masonry	100%	0.0%	0.0%	0.0%	0.0%	97.7%	1.5%	0.8%	0.0%	0.0%	87.9%	6.1%	4.7%	1.3%	0.0%
Un-reinforced Masonry	100%	0.0%	0.0%	0.0%	0.0%	95.1%	3.3%	1.3%	0.2%	0.0%	81.2%	11.1%	6.0%	1.4%	0.2%
Manufactured housing	100%	0.0%	0.0%	0.0%	0.0%	96.2%	2.9%	0.9%	0.0%	0.0%	81.4%	11.8%	6.4%	0.4%	0.0%

Source: HAZUS-MH 2.0

Note: The percentages in the table above are based on the County’s building count in the HAZUS-MH earthquake model of 23,768 buildings.



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-14. Estimated Building Value (Building and Contents) Damaged by the 500- and 2,500-Year MRP Earthquake Events

Municipality	Estimated Total Damages*		Percent of Total Building and Contents RV**		Estimated Residential Damage		Estimated Commercial Damage	
	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year
Barton (T)	\$68,694	\$757,501	0.02	0.18	\$50,080	\$507,961	\$9,489	\$112,303
Berkshire (T)	\$0	\$584,132		0.11	\$0	\$448,067	\$0	\$75,786
Newark Valley (T)								
Newark Valley (V)								
Richford (T)								
Candor (T)	\$286,120	\$2,669,421	0.06	0.59	\$217,604	\$1,950,712	\$32,950	\$346,455
Candor (V)								
Nichols (T)	\$116,714	\$1,219,526	0.02	0.18	\$89,015	\$890,175	\$15,109	\$175,706
Nichols (V)								
Tioga (T)								
Owego (T)	\$283,213	\$3,274,159	0.02	0.18	\$213,945	\$2,374,020	\$37,417	\$445,779
Owego (V)	\$1,156,987	\$10,287,551	0.21	1.84	\$582,803	\$4,712,013	\$373,377	\$3,654,848
Spencer (T)	\$48,819	\$513,698	0.02	0.18	\$35,829	\$363,392	\$8,480	\$94,710
Spencer (V)								
Waverly (V)	\$312,370	\$3,227,384	0.06	0.60	\$192,027	\$1,844,842	\$54,105	\$590,128
Tioga County	\$2,272,916	\$22,533,372	0.04	0.42	\$1,381,301	\$13,091,182	\$530,927	\$5,495,715

Source: HAZUS-MH 2.0

RV Replacement Value

*Total is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious and government)].

**Total replacement value for Tioga County is approximately \$5.3 billion.

The HAZUS-MH earthquake model results are reported by Census Tract. In some cases, there is more than one municipality per Census Tract.



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

It is estimated that there would be \$2.3M in building damages during a 500-year earthquake event. This includes structural damage, non-structural damage and loss of contents, representing 0.04-percent of the total replacement value for general building stock in Tioga County. For a 2,500-year MRP earthquake event, the estimated total building damage is greater than \$22.5M or approximately 0.42-percent of the total general building stock replacement value (total replacement value is greater than \$5.3B for the County). Residential and commercial buildings account for most of the damage for earthquake events. This is likely because they comprise the majority of the building inventory.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 100-, 500- and 2,500-year MRP earthquake events, critical facilities were evaluated. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities and user-defined facilities) in Tioga County are considered exposed and vulnerable to the earthquake hazard. Refer to subsection “Critical Facilities” in Section 4 (County Profile) of this Plan for a complete inventory of critical facilities. However, the degree of exposure is dependent on many factors, including the age and construction type of buildings and the soil type buildings are constructed on.

Critical facilities located on NEHRP soil types D and E have a greater/higher seismic risk or exposure. Table 5.4.5-15 summarizes the NEHRP soil type each critical facility is located on.

Table 5.4.5-15. Critical Facilities in Tioga County

Name	Address	City	Facility Type	NEHRP	Building Type
TBD		Barton (T)	Medical Care	D	S1L
TBD		Barton (T)	Medical Care	D	S1L
Waverly Station #2	1627 Rt. 17C	Barton (T)	Fire Station	D	URML
Lockwood	34 Main Street, Lockwood	Barton (T)	Fire Station	D	URML
Waverly Fire Station #2	6698 State Route 17C	Barton (T)	EOC	D	URML
Lockwood	6836 Main St	Barton (T)	EOC	D	URML
Barton Municipal Building	304 State Route 17C	Barton (T)	User Defined	B	URML
Barton Highway Barn	221 Shepard Rd	Barton (T)	User Defined	B	URML
NYS DOT Highway Garage	15 Pembleton Pl	Barton (T)	User Defined	D	URML
Berkshire Family Medicine	Family Practice	Berkshire (T)	Medical Care	E	S1L
Berkshire	12515 State Route 38	Berkshire (T)	Fire Station	D	URML
Berkshire Emergency Squad	12515 State Route 38	Berkshire (T)	Fire Station	D	URML
Berkshire Town Hall	18 Railroad Ave	Berkshire (T)	User Defined	E	URML
Berkshire Town Barn	12633 State Route 38	Berkshire (T)	User Defined	D	URML
Candor Elderly Housing	Spencer Rd	Candor (T)	User Defined	D	URML
Willseyville Station	462 Ithaca Rd	Candor (T)	Fire Station	D	URML
Weltonville	3232 West Creek Road,	Candor (T)	Fire Station	E	URML
Candor Main Station	74 Owego Road	Candor (T)	Fire Station	D	URML
Weltonville Fire Station	5407 West Creek Rd	Candor (T)	EOC	E	URML
Candor Main Station	5489 Owego Rd	Candor (T)	EOC	D	URML
Candor Town Hall	101 Owego Rd	Candor (T)	User Defined	D	URML
Town of Candor Highway Barn	33 Humiston St	Candor (T)	User Defined	D	URML
Allen Memorial Baptist Church		Candor (V)	User Defined	D	URML
TBD		Candor (V)	Medical Care	D	S1L
Candor Family Care	Family Practice	Candor (V)	Medical Care	D	S1L
Candor Emergency Squad	Main Street, Candor	Candor (V)	Fire Station	D	URML

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Name	Address	City	Facility Type	NEHRP	Building Type
Candor Central Schools Bus		Candor (V)	School	D	URML
Candor Elementary School		Candor (V)	School	D	URML
Camdor High School		Candor (V)	School	D	URML
Candor Village Hall	138 Main St	Candor (V)	User Defined	D	URML
Village of Candor Public Works	8 Rich St	Candor (V)	User Defined	D	URML
North Tioga Family Care	Family Practice	Newark Valley (T)	Medical Care	E	S1L
Newark Valley Fire Station	4400 State Route 38	Newark Valley (T)	EOC	B	URML
Town of Newark Valley	89 Whig St	Newark Valley (T)	User Defined	E	URML
Berkshire EMS, Newark Valley	9 Park Street, Newark Valley	Newark Valley (V)	Fire Station	D	URML
Newark Valley Central School		Newark Valley (V)	School	E	URML
Nathan T Hall Elementary		Newark Valley (V)	School	D	URML
Newark Valley Middle School		Newark Valley (V)	School	D	URML
Newark Valley Central School		Newark Valley (V)	School	E	URML
Newark Valley Town Hall	109 Whig St	Newark Valley (V)	User Defined	E	URML
Village of Newark Valley Public	83 Whig St	Newark Valley (V)	User Defined	E	URML
Village of Newark Valley Hall	9 Park Street	Newark Valley (V)	User Defined	D	URML
Newark Valley	7164 State Route 38	Newton Valley (T)	Fire Station	B	URML
Newark Valley Central School		Newton Valley (T)	School	B	URML
Newark Valley High School		Newton Valley (T)	School	D	URML
Town of Nichols Highway	742 E River Rd	Nichols (T)	User Defined	B	URML
Nichols Schoolhouse	Cady Ave	Nichols (V)	User Defined	E	URML
Nichols	39 River Street, Nichols	Nichols (V)	Fire Station	B	URML
Nichols Fire Station	928 W River Rd	Nichols (V)	EOC	B	URML
Nichols Elementary School		Nichols (V)	School	B	URML
Nichols Elementary School		Nichols (V)	User Defined	B	URML
Nichols Town Hall	54 E River Rd	Nichols (V)	User Defined	E	URML
Village of Nichols Highway	61 Kirby St	Nichols (V)	User Defined	B	URML
Apalachin United Methodist		Owego (T)	User Defined	D	URML
Franziska Racker Center	McFadden Rd	Owego (T)	User Defined	D	URML
Guthrie Medical Apalachin	Regional Facility	Owego (T)	Medical Care	B	S1L
Apalachin Family Care	Family Practice	Owego (T)	Medical Care	D	S1L
Apalachin Station #1	230 Pennsylvania Ave.,	Owego (T)	Fire Station	D	URML
Apalachin Station #2	4283 Pennsylvania Ave.,	Owego (T)	Fire Station	B	URML
Apalachin Station #3	8924 State Route 434, Apalachin	Owego (T)	Fire Station	B	URML
Campville Station #1	6153 State Route 17C, Town of	Owego (T)	Fire Station	B	URML
Campville Station #2	4279 Gaskill Road, Town of	Owego (T)	Fire Station	B	URML
South Side	3120 Waits Road, Owego	Owego (T)	Fire Station	B	URML
New York State Police	2356 State Route 434	Owego (T)	Police Station	E	URML
Tioga County Sheriffs Office	Corporate Dr	Owego (T)	Police Station	D	URML
Apalachin Fire Station #1	3914 Pennsylvania Ave	Owego (T)	EOC	D	URML
Campville Fire Station #1	2747 State Route 17C	Owego (T)	EOC	B	URML
South Side Fire Station	3839 Waits Rd	Owego (T)	EOC	B	URML
Tioga County Pubic Safety	2849 Corporate Dr	Owego (T)	EOC	D	URML
Owego-Apalachin Central		Owego (T)	School	E	URML
Owego-Apalachin Central		Owego (T)	School	E	URML
Owego-Apalachin Central		Owego (T)	School	B	URML
Thomas J Watson Sr		Owego (T)	School	B	URML
Tioga Hills Elementary School		Owego (T)	School	B	URML

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Name	Address	City	Facility Type	NEHRP	Building Type
Apalachin Elementary School		Owego (T)	School	D	URML
Tioga Learning Center		Owego (T)	School	D	URML
Playyard Concepts, Inc.		Owego (T)	School	D	URML
Miss Karen's School of Dance		Owego (T)	School	D	URML
Abide in the Vine Fellowship		Owego (T)	User Defined	B	URML
Apalachin Christian &		Owego (T)	User Defined	B	URML
El Rancho de Paz		Owego (T)	User Defined	B	URML
Tioga County Public Safety	103 Corporate Dr	Owego (T)	User Defined	D	URML
Owego Town Hall	2354-2356 State Route 434	Owego (T)	User Defined	E	URML
Tioga County Jail	103 Corporate Dr	Owego (T)	User Defined	D	URML
Tioga County Health & Human	1062 State Route 38	Owego (T)	User Defined	D	URML
Tioga County Soil & Water	183 Corporate Dr	Owego (T)	User Defined	D	URML
Town of Owego Highway	70 Delphine St	Owego (T)	User Defined	D	URML
NYS DOT Residency	1497 State Route 96	Owego (T)	User Defined	E	URML
NYS DOT Salt Dome	State Route 96	Owego (T)	User Defined	E	URML
Riverview Manor Health Care	Fifth Ave	Owego (V)	User Defined	E	URML
Long Meadow Apartments	Sheldon Guile Blvd	Owego (V)	User Defined	D	URML
TBD		Owego (V)	Medical Care	E	S1L
Guthrie Medical Owego	Regional Facility	Owego (V)	Medical Care	D	S1L
Lourdes Owego Family	Family Practice	Owego (V)	Medical Care	E	S1L
Dr Keith A Nichols Office	Family Practice	Owego (V)	Medical Care	E	S1L
Owego UMA Family Practice	Family Practice	Owego (V)	Medical Care	E	S1L
Owego Central Station	87 North Avenue, Owego	Owego (V)	Fire Station	E	URML
Owego Station #2	North Avenue, Owego	Owego (V)	Fire Station	E	URML
Owego Talcott St.	Talcott Street, Owego	Owego (V)	Fire Station	D	URML
Owego Station #4	Montrose Ave & South Side	Owego (V)	Fire Station	D	URML
Owego Police Department	90 Temple St	Owego (V)	Police Station	E	URML
Owego Central Fire Station	512 North Ave	Owego (V)	EOC	E	URML
St. Patrick School		Owego (V)	School	E	URML
Owego Elementary School		Owego (V)	School	E	URML
Owego Free Academy		Owego (V)	School	E	URML
Owego-Apalachin Middle		Owego (V)	School	E	URML
Tioga County Rural Ministry		Owego (V)	School	D	URML
Turtletown Day Care Center		Owego (V)	School	E	URML
Tioga County Building &	62-64 Temple St	Owego (V)	User Defined	E	URML
Tioga County Building &	68 Temple St	Owego (V)	User Defined	E	URML
Owego Village Court House	90 Temple St	Owego (V)	User Defined	E	URML
Owego Village Hall	178 Main St	Owego (V)	User Defined	E	URML
Tioga County Office Building	56 Main St	Owego (V)	User Defined	E	URML
Tioga County Court House	Court St	Owego (V)	User Defined	E	URML
Tioga County Clerks Building	16 Court St	Owego (V)	User Defined	E	URML
Tioga County Court Annex	20 Court St	Owego (V)	User Defined	E	URML
Village of Owego Public Works	20 Elm St	Owego (V)	User Defined	D	URML
Countryside Community		Owego (V)	User Defined	D	URML
North Tioga Center for Family	Primary Care Location	Richford (T)	Medical Care	E	S1L
Richford	988 Route 79, Richford	Richford (T)	Fire Station	E	URML
Richford Town Hall	7 Bowery Ln	Richford (T)	User Defined	E	URML
Richford Highway Garage	10 Town Barn Rd	Richford (T)	User Defined	E	URML



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Name	Address	City	Facility Type	NEHRP	Building Type
NYS DOT Salt Dome	12902 State Route 38	Richford (T)	User Defined	E	URML
Spencer Town Hall	79 E Tioga St	Spencer (T)	User Defined	D	URML
Town of Spencer Highway	81 E Tioga St	Spencer (T)	User Defined	D	URML
TBD		Spencer (V)	Medical Care	D	S1L
Spencer	41 North Main Street, Spencer	Spencer (V)	Fire Station	D	URML
Spencer Emergency Squad	47 West Tioga Street, Spencer	Spencer (V)	Fire Station	D	URML
Spencer	25161 N Main St	Spencer (V)	EOC	D	URML
Spencer Village Hall	41 N Main St	Spencer (V)	User Defined	D	URML
Candor Station #2	458 Route 96, Town of Tioga	Tioga (T)	Fire Station	E	URML
Halsey Valley	506 Hamilton Valley Road,	Tioga (T)	Fire Station	B	URML
Tioga Center	60 Fifth Avenue, Tioga Center	Tioga (T)	Fire Station	B	URML
Tioga Center Fire Station	1145 Fifth Ave	Tioga (T)	EOC	B	URML
Halsey Valley	1518 Hamilton Valley Rd	Tioga (T)	EOC	B	URML
Tioga Elementary School		Tioga (T)	School	B	URML
Tioga Middle School		Tioga (T)	School	B	URML
Tioga Senior High School		Tioga (T)	School	B	URML
Owego Nazarene Church		Tioga (T)	User Defined	E	URML
Tioga Town Hall	54 Fifth Ave	Tioga (T)	User Defined	B	URML
Tioga Highway Garage	46 Halsey Valley Rd	Tioga (T)	User Defined	B	URML
Tioga County Public Works &	477 Rt 96	Tioga (T)	User Defined	E	URML
Guthrie-Tioga Senior Enrich &	N Chemung St	Waverly (V)	User Defined	D	URML
Elderwood Health Care at	Ball St	Waverly (V)	User Defined	D	URML
Spring View Apartments	Spring St	Waverly (V)	User Defined	D	URML
Guthrie Waverly Optometry	Regional Facility	Waverly (V)	Medical Care	D	S1L
Elderwood Health Care at		Waverly (V)	Medical Care	D	S1L
Guthrie Medical Waverly	Regional Facility	Waverly (V)	Medical Care	D	S1L
Waverly Main Station	94 William Donnelly Parkway,	Waverly (V)	Fire Station	D	URML
Waverly Police Department	Broad St	Waverly (V)	Police Station	D	URML
Elm Street Stadium		Waverly (V)	School	D	URML
Waverly High School		Waverly (V)	School	D	URML
Waverly Middle School		Waverly (V)	School	D	URML
St. James Parochial School		Waverly (V)	School	D	URML
Elm Street Elementary School		Waverly (V)	School	D	URML
Waverly Central School		Waverly (V)	School	D	URML
Lincoln Street Elementary		Waverly (V)	School	D	URML
Waverly Head Start		Waverly (V)	School	D	URML
Village of Waverly Justice	358 Broad St	Waverly (V)	User Defined	D	URML
Waverly Village Hall	32 Ithaca St	Waverly (V)	User Defined	D	URML
Tioga County DSS Satellite	80 William Donnelly Pkwy	Waverly (V)	User Defined	D	URML
Waverly Public Works	81 Spring St	Waverly (V)	User Defined	D	URML
Waverly Public Works Garage	83 Spring St	Waverly (V)	User Defined	D	URML
NYS DOT Salt Dome	Pembleton Place	Waverly (V)	User Defined	D	URML

Source: O'Brien, 2008; Tioga County, 2012

Notes: NA = Not available.

URML = Unreinforced Masonry

S1L = Steel

HAZUS-MH 2.0 estimates the probability that critical facilities may sustain damage as a result of 100-, 500- and 2,500-year MRP earthquake events. Additionally, HAZUS-MH estimates the probability of



each facility being functional days after the event. For the 100-Year MRP event, HAZUS-MH 2.0 emergency facilities (police, fire, EMS and medical facilities), schools and specific facilities identified by the County as critical (i.e., user-defined facilities such shelters, municipal buildings) will be functional on day one of the event. Therefore, the impact to critical facilities is not significant for the 100-year event.

Tables 5.4.5-16 and 5.4.5-17 list the probability of critical facilities sustaining the damage category as defined by the column heading and percent functionality after the event for the 500-year and 2,500-year MRP earthquake events.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-16. Estimated Damage and Loss of Functionality for Critical Facilities in Tioga County for the 500-Year MRP Earthquake Event

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
TBD	Barton (T)	Medical Care	99.3	0.6	0.1	0	0	99.3	99.8	99.9
TBD	Barton (T)	Medical Care	99.3	0.6	0.1	0	0	99.3	99.8	99.9
TBD	Candor (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
TBD	Owego (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
TBD	Spencer (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Guthrie Medical Apalachin	Owego (T)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Guthrie Medical Owego	Owego (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Guthrie Waverly Optometry	Waverly (V)	Medical Care	99.2	0.6	0.1	0	0	99.3	99.8	99.9
Elderwood Health Care at Tioga	Waverly (V)	Medical Care	99.3	0.6	0.1	0	0	99.3	99.8	99.9
North Tioga Center for Family Health	Richford (T)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Apalachin Family Care	Owego (T)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Candor Family Care	Candor (V)	Medical Care	99.2	0.6	0.1	0	0	99.2	99.8	99.9
Guthrie Medical Waverly	Waverly (V)	Medical Care	99.3	0.6	0.1	0	0	99.3	99.8	99.9
Berkshire Family Medicine	Berkshire (T)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Lourdes Owego Family Practice	Owego (V)	Medical Care	99.2	0.6	0.1	0	0	99.2	99.8	99.9
Dr Keith A Nichols Office	Owego (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
North Tioga Family Care Center	Newark Valley (T)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Owego UMA Family Practice	Owego (V)	Medical Care	99.3	0.6	0.1	0	0	99.2	99.8	99.9
Waverly Station #2	Barton (T)	Fire Station	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Lockwood	Barton (T)	Fire Station	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Berkshire	Berkshire (T)	Fire Station	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Berkshire Emergency Squad	Berkshire (T)	Fire Station	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Willseyville Station	Candor (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Weltonville	Candor (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Main Station	Candor (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Emergency Squad	Candor (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Berkshire EMS, Newark Valley	Newark Valley (V)	Fire Station	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Newark Valley	Newton Valley (T)	Fire Station	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Nichols	Nichols (V)	Fire Station	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Apalachin Station #1	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin Station #2	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin Station #3	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Campville Station #1	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Campville Station #2	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
South Side	Owego (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Central Station	Owego (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Station #2	Owego (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Talcott St.	Owego (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Station #4	Owego (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Richford	Richford (T)	Fire Station	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Spencer	Spencer (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Spencer Emergency Squad	Spencer (V)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Station #2	Tioga (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Halsey Valley	Tioga (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Center	Tioga (T)	Fire Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Waverly Main Station	Waverly (V)	Fire Station	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
New York State Police	Owego (T)	Police Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Police Department	Owego (V)	Police Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Waverly Police Department	Waverly (V)	Police Station	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Tioga County Sheriffs Office	Owego (T)	Police Station	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin Fire Station #1	Owego (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Campville Fire Station #1	Owego (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Newark Valley Fire Station	Newark Valley (T)	EOC	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Nichols Fire Station	Nichols (V)	EOC	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Owego Central Fire Station	Owego (V)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Center Fire Station	Tioga (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Waverly Fire Station #2	Barton (T)	EOC	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Weltonville Fire Station	Candor (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
South Side Fire Station	Owego (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Tioga County Pubic Safety Building	Owego (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Main Station	Candor (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Spencer	Spencer (V)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Halsey Valley	Tioga (T)	EOC	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Lockwood	Barton (T)	EOC	96.1	2.9	0.9	0.1	0	96.0	98.9	99.8
Newark Valley Central School	Newton Valley (T)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Owego-Apalachin Central School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego-Apalachin Central School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego-Apalachin Central School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Central Schools Bus Garage	Candor (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Newark Valley Central School Bus Garage	Newark Valley (V)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Elm Street Stadium	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Newark Valley High School	Newton Valley (T)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Thomas J Watson Sr Elementary School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Hills Elementary School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin Elementary School	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Learning Center	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Elementary School	Tioga (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Middle School	Tioga (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Senior High School	Tioga (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Elementary School	Candor (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Camdor High School	Candor (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Nichols Elementary School	Nichols (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Nathan T Hall Elementary School	Newark Valley (V)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Newark Valley Middle School	Newark Valley (V)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Newark Valley Central School Warehouse	Newark Valley (V)	School	95.7	3.1	1	0.1	0	95.7	98.8	99.8
St. Patrick School	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Elementary School	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Free Academy	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego-Apalachin Middle School	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Tioga County Rural Ministry	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Waverly High School	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Waverly Middle School	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
St. James Parochial School	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Elm Street Elementary School	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Waverly Central School Garage	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Lincoln Street Elementary School	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Playyard Concepts, Inc.	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Miss Karen's School of Dance	Owego (T)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Wavely Head Start	Waverly (V)	School	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Turtletown Day Care Center	Owego (V)	School	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin United Methodist Church	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Abide in the Vine Fellowship	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Apalachin Christian & Missionary Allianc	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Nazarene Church	Tioga (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
El Rancho de Paz	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Nichols Elementary School	Nichols (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Village of Waverly Justice Court	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Tioga County Public Safety Building	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Town Hall	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Jail	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Health & Human Services Bui	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Building & Grounds	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Building & Grounds	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Barton Municipal Building	Barton (T)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Waverly Village Hall	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Berkshire Town Hall	Berkshire (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Candor Town Hall	Candor (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Village Hall	Candor (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Owego Village Court House	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Newark Valley Town Hall	Newark Valley (V)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Nichols Town Hall	Nichols (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Owego Village Hall	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Richford Town Hall	Richford (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Spencer Town Hall	Spencer (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Spencer Village Hall	Spencer (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Town Hall	Tioga (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Office Building	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Court House	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Clerks Building	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Court Annex	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County Soil & Water Conservation	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga County DSS Satellite Clinic	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Barton Highway Barn	Barton (T)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Berkshire Town Barn	Berkshire (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Town of Candor Highway Barn	Candor (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Village of Candor Public Works Garage	Candor (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Town of Newark Valley Highway Barn	Newark Valley (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Village of Newark Valley Public Works Ga	Newark Valley (V)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Town of Nichols Highway Garage	Nichols (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Village of Nichols Highway Garage	Nichols (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Town of Owego Highway Garage	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Village of Owego Public Works Garage	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Richford Highway Garage	Richford (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Town of Spencer Highway Garage	Spencer (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Tioga Highway Garage	Tioga (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Waverly Public Works	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Waverly Public Works Garage	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
NYS DOT Residency	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
NYS DOT Highway Garage	Barton (T)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Tioga County Public Works & Highway Depa	Tioga (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Village of Newark Valley Hall	Newark Valley (V)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
Countryside Community Center	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Riverview Manor Health Care Center	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Nichols Schoolhouse Apartments	Nichols (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Long Meadow Apartments	Owego (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Candor Elderly Housing	Candor (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Franziska Racker Center	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
Guthrie-Tioga Senior Enrich & Assis Liv	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Elderwood Health Care at Tioga	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Spring View Apartments	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
NYS DOT Salt Dome	Owego (T)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8
NYS DOT Salt Dome	Richford (T)	User Defined	95.7	3.1	1	0.1	0	95.7	98.8	99.8
NYS DOT Salt Dome	Waverly (V)	User Defined	96.1	2.9	0.9	0.1	0	96	98.9	99.8
Allen Memorial Baptist Church	Candor (V)	User Defined	95.9	3	0.9	0.1	0	95.9	98.9	99.8

Source: HAZUS-MH 2.0



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-17. Estimated Damage and Loss of Functionality for Critical Facilities in Tioga County for the 2,500-Year MRP Earthquake Event

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
TBD	Barton (T)	Medical Care	85.2	9.7	4.6	0.3	0.1	85.2	94.9	99.5
TBD	Barton (T)	Medical Care	85.2	9.7	4.6	0.3	0.1	85.2	94.9	99.5
Waverly Station #2	Barton (T)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Lockwood	Barton (T)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Waverly Fire Station #2	Barton (T)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Lockwood	Barton (T)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Barton Municipal Building	Barton (T)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Barton Highway Barn	Barton (T)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
NYS DOT Highway Garage	Barton (T)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Berkshire Family Medicine	Berkshire (T)	Medical Care	84.2	10.3	5	0.4	0.1	84.1	94.4	99.4
Berkshire	Berkshire (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Berkshire Emergency Squad	Berkshire (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Berkshire Town Hall	Berkshire (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Berkshire Town Barn	Berkshire (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Willseyville Station	Candor (T)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Weltonville	Candor (T)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Main Station	Candor (T)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Weltonville Fire Station	Candor (T)	EOC	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Main Station	Candor (T)	EOC	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Town Hall	Candor (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Town of Candor Highway Barn	Candor (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Elderly Housing	Candor (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
TBD	Candor (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Candor Family Care	Candor (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Candor Emergency Squad	Candor (V)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Central Schools Bus Garage	Candor (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Elementary School	Candor (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Camdor High School	Candor (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Candor Village Hall	Candor (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Village of Candor Public Works Garage	Candor (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Allen Memorial Baptist Church	Candor (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
North Tioga Family Care Center	Newark Valley (T)	Medical Care	84.2	10.3	5	0.4	0.1	84.1	94.4	99.4
Newark Valley Fire Station	Newark Valley (T)	EOC	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Town of Newark Valley Highway Barn	Newark Valley (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Berkshire EMS, Newark Valley	Newark Valley (V)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley Central School Bus Garage	Newark Valley (V)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Nathan T Hall Elementary School	Newark Valley (V)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley Middle School	Newark Valley (V)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley Central School Warehouse	Newark Valley (V)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley Town Hall	Newark Valley (V)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Village of Newark Valley Public Works Ga	Newark Valley (V)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Village of Newark Valley Hall	Newark Valley (V)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley	Newton Valley (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley Central School	Newton Valley (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Newark Valley High School	Newton Valley (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Town of Nichols Highway Garage	Nichols (T)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols	Nichols (V)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols Fire Station	Nichols (V)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols Elementary School	Nichols (V)	School	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols Elementary School	Nichols (V)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols Town Hall	Nichols (V)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Village of Nichols Highway Garage	Nichols (V)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Nichols Schoolhouse Apartments	Nichols (V)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Guthrie Medical Apalachin	Owego (T)	Medical Care	84.2	10.3	5	0.4	0.1	84.1	94.4	99.4
Apalachin Family Care	Owego (T)	Medical Care	84.2	10.3	5	0.4	0.1	84.1	94.4	99.4
Apalachin Station #1	Owego (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Apalachin Station #2	Owego (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Apalachin Station #3	Owego (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Campville Station #1	Owego (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Campville Station #2	Owego (T)	Fire Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
South Side	Owego (T)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
New York State Police	Owego (T)	Police Station	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Tioga County Sheriffs Office	Owego (T)	Police Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Apalachin Fire Station #1	Owego (T)	EOC	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Campville Fire Station #1	Owego (T)	EOC	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
South Side Fire Station	Owego (T)	EOC	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Pubic Safety Building	Owego (T)	EOC	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego-Apalachin Central School	Owego (T)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego-Apalachin Central School	Owego (T)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego-Apalachin Central School	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Thomas J Watson Sr Elementary School	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Tioga Hills Elementary School	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Apalachin Elementary School	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Tioga Learning Center	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Playyard Concepts, Inc.	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Miss Karen's School of Dance	Owego (T)	School	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Apalachin United Methodist Church	Owego (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Abide in the Vine Fellowship	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Apalachin Christian & Missionary Allianc	Owego (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
El Rancho de Paz	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Public Safety Building	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Town Hall	Owego (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
Tioga County Jail	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Health & Human Services Bui	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Soil & Water Conservation	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Town of Owego Highway Garage	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
NYS DOT Residency	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Franziska Racker Center	Owego (T)	User Defined	80.3	12.5	6	1.1	0.1	80.3	92.7	98.7
NYS DOT Salt Dome	Owego (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
TBD	Owego (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Guthrie Medical Owego	Owego (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Lourdes Owego Family Practice	Owego (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Dr Keith A Nichols Office	Owego (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Owego UMA Family Practice	Owego (V)	Medical Care	84.8	10	4.7	0.4	0.1	84.7	94.7	99.4
Owego Central Station	Owego (V)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Station #2	Owego (V)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Talcott St.	Owego (V)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Station #4	Owego (V)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Police Department	Owego (V)	Police Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Central Fire Station	Owego (V)	EOC	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
St. Patrick School	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Elementary School	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Free Academy	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego-Apalachin Middle School	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Rural Ministry	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Turtletown Day Care Center	Owego (V)	School	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Building & Grounds	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Building & Grounds	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Village Court House	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Owego Village Hall	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Office Building	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Court House	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Clerks Building	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga County Court Annex	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Village of Owego Public Works Garage	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Countryside Community Center	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Riverview Manor Health Care Center	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Long Meadow Apartments	Owego (V)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
North Tioga Center for Family Health	Richford (T)	Medical Care	83.9	10.5	5.1	0.4	0.1	83.9	94.3	99.4



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Richford	Richford (T)	Fire Station	80.1	12.6	6.1	1.1	0.1	80.1	92.6	98.7
Richford Town Hall	Richford (T)	User Defined	80.1	12.6	6.1	1.1	0.1	80.1	92.6	98.7
Richford Highway Garage	Richford (T)	User Defined	80.1	12.6	6.1	1.1	0.1	80.1	92.6	98.7
NYS DOT Salt Dome	Richford (T)	User Defined	80.1	12.6	6.1	1.1	0.1	80.1	92.6	98.7
Spencer Town Hall	Spencer (T)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Town of Spencer Highway Garage	Spencer (T)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
TBD	Spencer (V)	Medical Care	85	9.9	4.6	0.4	0.1	84.9	94.8	99.4
Spencer	Spencer (V)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Spencer Emergency Squad	Spencer (V)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Spencer	Spencer (V)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Spencer Village Hall	Spencer (V)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Candor Station #2	Tioga (T)	Fire Station	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Halsey Valley	Tioga (T)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Center	Tioga (T)	Fire Station	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Center Fire Station	Tioga (T)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Halsey Valley	Tioga (T)	EOC	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Elementary School	Tioga (T)	School	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Middle School	Tioga (T)	School	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Senior High School	Tioga (T)	School	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Owego Nazarene Church	Tioga (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Tioga Town Hall	Tioga (T)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga Highway Garage	Tioga (T)	User Defined	80.8	12.2	5.8	1.1	0.1	80.7	93	98.8
Tioga County Public Works & Highway Depa	Tioga (T)	User Defined	80.6	12.3	5.9	1.1	0.1	80.5	92.8	98.7
Guthrie Waverly Optometry	Waverly (V)	Medical Care	85.2	9.7	4.6	0.3	0.1	85.2	94.9	99.5
Elderwood Health Care at Tioga	Waverly (V)	Medical Care	85.2	9.7	4.6	0.3	0.1	85.2	94.9	99.5
Guthrie Medical Waverly	Waverly (V)	Medical Care	85.2	9.7	4.6	0.3	0.1	85.2	94.9	99.5
Waverly Main Station	Waverly (V)	Fire Station	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Police Department	Waverly (V)	Police Station	81	12.1	5.7	1	0.1	81	93.1	98.8
Elm Street Stadium	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly High School	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Probability of Sustaining Damage (%)					Probability of Being Functional (%)		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Waverly Middle School	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
St. James Parochial School	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Elm Street Elementary School	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Central School Garage	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Lincoln Street Elementary School	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Head Start	Waverly (V)	School	81	12.1	5.7	1	0.1	81	93.1	98.8
Village of Waverly Justice Court	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Village Hall	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Tioga County DSS Satellite Clinic	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Public Works	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Waverly Public Works Garage	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Guthrie-Tioga Senior Enrich & Assis Liv	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Elderwood Health Care at Tioga	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
Spring View Apartments	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8
NYS DOT Salt Dome	Waverly (V)	User Defined	81	12.1	5.7	1	0.1	81	93.1	98.8

Source: HAZUS-MH 2.0

Notes: T = Town and V = Village



Impact on Economy

Earthquakes also have impacts on the economy, including: loss of business function, damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. A Level 2 HAZUS-MH analysis estimates the total economic loss associated with each earthquake scenario, which includes building- and lifeline-related losses (transportation and utility losses) based on the available inventory (facility [or GIS point] data only). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the “Impact on General Building Stock” section discussed earlier. Lifeline-related losses include the direct repair cost to transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic loss includes business interruption losses associated with the inability to operate a business due to the damage sustained during the earthquake as well as temporary living expenses for those displaced. These losses are discussed below.

Table 5.4.5-18 summarizes the total direct building economic losses to the Tioga County inventory. This includes inventory, relocation, income and wage loss in addition to including building and content damages. In summary, for the 500-year event, HAZUS-MH estimates Tioga County will incur approximately \$1.22M in business interruption losses. For the 2,500-year event, HAZUS-MH estimates Tioga County will incur approximately \$9.97M in income losses, mainly to the residential and commercial occupancy classes associated with wages, loss of income, rental and relocation.

For the 100-year MRP, in terms of utilities, HAZUS-MH estimates that all of the utilities will be functional on day 1 of the event. Damage results are not considered to be significant as a result of a 100-year event; therefore, utility loss estimates are not discussed further in this assessment for this HMP.

Tables 5.4.5-19 and 5.4.5-20 summarize the HAZUS-MH 2.0 estimated probability of damage that each utility may sustain (as defined by the column heading) and estimated loss of use in days a result of a 500-year and 2,500-year MRP earthquake event, respectively. Damage categories are related to the damage ratio (defined as ratio of repair to replacement cost) for evaluation of direct economic loss. Refer to the HAZUS-MH Earthquake Technical Manual for a description of the damage categories for each utility feature.

In terms of transportation, roadway segments and railroad tracks may experience damage due to ground failure. Damage estimates to these components were not calculated by HAZUS. It is assumed that regional transportation and distribution of materials may be interrupted as a result of an earthquake event. Losses to the community that result from damages to lifelines can be much greater than the cost of repair.

For the 100-year MRP event, HAZUS-MH 2.0 estimates 100% of highway bridges will be functional day one of the event. For the 500-year MRP event, HAZUS-MH estimates that 99.9% of the highway bridges will be functional day one of the event. For the 2,500-year MRP event, HAZUS-MH estimates 97.9% of the highway bridges will be functional day one of the event.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-18. Estimated Total Direct Economic Building Loss** by the 500- and 2,500-Year MRP Earthquake Events

Municipality	Estimated Total Damages*		Estimated Residential Damage		Estimated Commercial Damage	
	500-Year	2,500-Year	500-Year	2,500-Year	500-Year	2,500-Year
Barton (T)	\$103,612	\$1,023,336	\$66,649	\$631,737	\$23,301	\$217,087
Berkshire (T)	\$0	\$815,359	\$0	\$563,372	\$0	\$165,913
Newark Valley (T)						
Newark Valley (V)						
Richford (T)						
Candor (T)	\$404,043	\$3,540,977	\$280,497	\$2,385,086	\$73,257	\$670,392
Candor (V)						
Nichols (T)	\$186,612	\$1,727,551	\$125,727	\$1,159,547	\$38,882	\$348,495
Nichols (V)						
Tioga (T)						
Owego (T)	\$420,000	\$4,322,159	\$271,644	\$2,808,479	\$99,012	\$348,495
Owego (V)	\$1,832,879	\$15,973,679	\$744,246	\$5,756,226	\$807,772	\$7,598,450
Spencer (T)	\$73,797	\$694,638	\$47,522	\$447,770	\$19,670	\$174,601
Spencer (V)						
Waverly (V)	\$486,792	\$4,570,652	\$266,061	\$2,365,171	\$133,443	\$1,227,761
Tioga County	\$3,507,735	\$32,668,351	\$1,802,346	\$16,117,388	\$1,195,337	\$10,751,194

Source: HAZUS-MH 2.0

RV Replacement Value

*Total is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious and government)].

** This includes inventory, relocation, income and wage losses in addition to including building and content damages.

The HAZUS-MH earthquake model results are reported by Census Tract. In some cases, there is more than one municipality per Census Tract.



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-19. Estimated Utility Impacts in Tioga County from the 500-year MRP Earthquake Event

500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well 1	Tioga (T)	Pot. Water Fac.	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Newark Valley (T)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Well 2	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 3	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Spencer (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Nichols (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Nichols (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Barton (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Barton (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Newark Valley (T)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Well 2	Newark Valley (T)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Well 1	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 3	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 4	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Spencer (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Spencer (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Tioga (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Barton (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Barton (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Ward Street well 1	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Ball Park well 2	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well 3 shop well	Newark Valley (V)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Well 4 trout pond well	Newark Valley (V)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Well 1	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Waverly (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 2	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Nichols (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 1	Owego (V)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 3	Owego (V)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 4	Owego (V)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Well 3	Waverly (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 4	Waverly (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Well 4	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 1	Newark Valley (T)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Water Tank 2	Candor (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 3	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 4	Candor (T)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Water Tank 5	Waverly (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 6	Nichols (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 7	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 8	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 9	Owego (V)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 10	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 11	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Tank 12	Waverly (V)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Reservoir	Nichols (T)	Pot. Water Fac	99	0.9	0.2	0	0	99.5	99.9	99.9
Reservoir	Newark Valley (V)	Pot. Water Fac	98.8	1	0.2	0	0	99.4	99.9	99.9
Reservoir	Owego (T)	Pot. Water Fac	98.9	0.9	0.2	0	0	99.5	99.9	99.9
Water Pollution Control Plant #2	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
Valley View Hts Plan of 1977 JCAAdams	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
Southside STP Owego	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
Village of Waverly -note from map	Waverly (V)	Waste Water Fac	99	0.9	0.2	0	0	99.2	99.9	99.9
STP Owego south of Taylor Road	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
note 1946 map	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Waverly (V)	Waste Water Fac	99	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (T)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
WW Pump Station	Owego (V)	Waste Water Fac	98.9	0.9	0.2	0	0	99.2	99.9	99.9
VERIZON NEW YORK, INC.	Nichols (V)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
VERIZON NEW YORK, INC.	Owego (V)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
VERIZON NEW YORK, INC.	Waverly (V)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Berkshire (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
CITIZENS TELECOMM CO OF NY DBA	Berkshire (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Barton (T)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Newark Valley (V)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Spencer (V)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Candor (V)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Tioga County Highway Department	Tioga (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Public Safety Building Tower	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Ballou Hill Road Microwave Tower Site	Tioga (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Carmichael Hill Road Radio Tower Site	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Spaulding Hill Backup Radio Tower Site	Tioga (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
Popple Hill Radio Tower Site	Richford (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
Candor Hill Radio Tower Site	Candor (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
Ridge Road Radio Tower Site	Barton (T)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
WATS BROADCASTING, INC.	Barton (T)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
FAMILY LIFE MINISTRIES, INC.	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NYNEX Mobile of New York, LP	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
BINGHAMTON MSA LIMITED PARTNERSHIP	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (V)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NYSEG	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NYSEG	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NYSEG	Richford (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Nichols (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
NEW CINGULAR WIRELESS PCS, LLC	Nichols (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
WEBO	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
NYSEG	Richford (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
NYSEG	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
W225BC	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
W229AR	Barton (T)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
W240AJ	Owego (T)	Communications	98.8	1	0.2	0	0	99.8	99.9	99.9
W273AB	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
W300BV	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9
WAVR	Barton (T)	Communications	99	0.9	0.2	0	0	99.9	99.9	99.9
WCII	Owego (T)	Communications	98.9	0.9	0.2	0	0	99.8	99.9	99.9

Source: HAZUS-MH 2.0

Notes: Pot. Water Fac = Potable Water Facility; T = Town; V = Village.



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

Table 5.4.5-20. Estimated Utility Impacts in Tioga County from the 2,500-year MRP Earthquake Event

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well 1	Tioga (T)	Pot. Water Fac.	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Newark Valley (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 2	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 3	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 2	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Spencer (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 1	Nichols (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 2	Nichols (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 1	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Barton (T)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 2	Barton (T)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 1	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Newark Valley (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 2	Newark Valley (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 1	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 2	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 3	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 4	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Spencer (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 2	Spencer (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 1	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Tioga (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 2	Barton (T)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 1	Owego (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Barton (T)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Ward Street well 1	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Ball Park well 2	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Well 3 shop well	Newark Valley (V)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 4 trout pond well	Newark Valley (V)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 1	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 2	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 1	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 2	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 1	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 2	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Well 1	Waverly (V)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 1	Owego (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 2	Owego (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 1	Nichols (V)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Well 1	Owego (V)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 3	Owego (V)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 4	Owego (V)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Well 3	Waverly (V)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 4	Waverly (V)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Well 4	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 1	Newark Valley (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 2	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Water Tank 3	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 4	Candor (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Water Tank 5	Waverly (V)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9
Water Tank 6	Nichols (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Water Tank 7	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 8	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 9	Owego (V)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Water Tank 10	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Tank 11	Owego (T)	Pot. Water Fac	89.7	7.1	3	0.1	0	94.9	99.8	99.9
Water Tank 12	Waverly (V)	Pot. Water Fac	90.1	6.9	2.9	0.1	0	95.1	99.8	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
Reservoir	Nichols (T)	Pot. Water Fac	89.9	7	2.9	0.1	0	95	99.8	99.9
Reservoir	Newark Valley (V)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Reservoir	Owego (T)	Pot. Water Fac	89.4	7.3	3.1	0.1	0	94.7	99.8	99.8
Water Pollution Control Plant #2	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.8
Valley View Hts Plan of 1977 JCAAdams	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.8
Southside STP Owego	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.8
Village of Waverly -note from map	Waverly (V)	Waste Water Fac	90.1	6.9	2.9	0.1	0	92.6	99.8	99.8
STP Owego south of Taylor Road	Owego (T)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.8
note 1946 map	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.8
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Waverly (V)	Waste Water Fac	90.1	6.9	2.9	0.1	0	92.6	99.8	99.9
WW Pump Station	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.4	7.3	3.1	0.1	0	92.1	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (T)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
WW Pump Station	Owego (V)	Waste Water Fac	89.7	7.1	3	0.1	0	92.3	99.8	99.9
VERIZON NEW YORK, INC.	Nichols (V)	Communications	89.9	7	2.9	0.1	0			
VERIZON NEW YORK, INC.	Owego (V)	Communications	89.7	7.1	3	0.1	0			
VERIZON NEW YORK, INC.	Waverly (V)	Communications	90.1	6.9	2.9	0.1	0			
CITIZENS TELECOMM CO OF NY DBA	Berkshire (T)	Communications	89.4	7.3	3.1	0.1	0			



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
CITIZENS TELECOMM CO OF NY DBA	Berkshire (T)	Communications	89.4	7.3	3.1	0.1	0	98.3	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Barton (T)	Communications	89.9	7	2.9	0.1	0	98.3	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Newark Valley (V)	Communications	89.4	7.3	3.1	0.1	0	98.4	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Spencer (V)	Communications	89.9	7	2.9	0.1	0	98.2	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Owego (T)	Communications	89.4	7.3	3.1	0.1	0	98.2	99.9	99.9
CITIZENS TELECOMM CO OF NY DBA	Candor (V)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
Tioga County Highway Department	Tioga (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
Public Safety Building Tower	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
Ballou Hill Road Microwave Tower Site	Tioga (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
Carmichael Hill Road Radio Tower Site	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
Spaulding Hill Backup Radio Tower Site	Tioga (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
Popple Hill Radio Tower Site	Richford (T)	Communications	89.2	7.4	3.2	0.1	0	98.3	99.9	99.9
Candor Hill Radio Tower Site	Candor (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
Ridge Road Radio Tower Site	Barton (T)	Communications	89.9	7	2.9	0.1	0	98.3	99.9	99.9
WATS BROADCASTING, INC.	Barton (T)	Communications	90.1	6.9	2.9	0.1	0	98.3	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
FAMILY LIFE MINISTRIES, INC.	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.4	99.9	99.9
NYNEX Mobile of New York, LP	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
BINGHAMTON MSA LIMITED PARTNERSHIP	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	89.4	7.3	3.1	0.1	0	98.3	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	89.4	7.3	3.1	0.1	0	98.3	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (V)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
RADIGAN BROADCASTING GROUP, LLC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
NYSEG	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
NYSEG	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
NYSEG	Richford (T)	Communications	89.2	7.4	3.2	0.1	0	98.3	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
NEW CINGULAR WIRELESS PCS, LLC	Nichols (T)	Communications	89.9	7	2.9	0.1	0	98.3	99.9	99.9



SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

2,500-Year MRP Event										
Name	Municipality	Type	Percent Probability of Sustaining Damage					Percent Functionality		
			None	Slight	Moderate	Extensive	Complete	Day 1	Day 14	Day 30
NEW CINGULAR WIRELESS PCS, LLC	Nichols (T)	Communications	89.9	7	2.9	0.1	0	98.3	99.9	99.9
WEBO	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9
NYSEG	Richford (T)	Communications	89.2	7.4	3.2	0.1	0	98.3	99.9	99.9
NYSEG	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
W225BC	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
W229AR	Barton (T)	Communications	90.1	6.9	2.9	0.1	0	98.3	99.9	99.9
W240AJ	Owego (T)	Communications	89.4	7.3	3.1	0.1	0	98.2	99.9	99.9
W273AB	Owego (T)	Communications	89.4	7.3	3.1	0.1	0	98.3	99.9	99.9
W300BV	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.3	99.9	99.9
WAVR	Barton (T)	Communications	90.1	6.9	2.9	0.1	0	98.4	99.9	99.9
WCII	Owego (T)	Communications	89.7	7.1	3	0.1	0	98.2	99.9	99.9

Source: HAZUS-MH 2.0

Notes: Pot. Water Fac = Potable Water Facility; T = Town; V = Village.

SECTION 5.4.5: RISK ASSESSMENT – EARTHQUAKE

HAZUS-MH 2.0 also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood and other debris that can be loaded directly onto trucks with bulldozers (HAZUS-MH Earthquake User’s Manual).

For the 100-year MRP event, HAZUS-MH estimates approximately 0 tons of debris will be generated. For the 500-year MRP event, HAZUS-MH estimates 2,267 tons of debris will be generated and for the 2,500-year MRP event, HAZUS-MH estimates approximately 15,296 tons of debris will be generated. Table 5.4.5-21 summarizes the estimated debris by the 500- and 2,500-year MRP earthquake events by municipality.

Table 5.4.5-21. Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Events

Municipality	500-Year		2,500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Barton (T)	69	18	424	158
Berkshire (T)	0	0	390	122
Newark Valley (T)				
Newark Valley (V)				
Richford (T)				
Candor (T)	220	63	1,154	568
Candor (V)				
Nichols (T)	118	29	690	246
Nichols (V)				
Tioga (T)				
Owego (T)	274	66	1,639	593
Owego (V)	679	307	3,116	3,609
Spencer (T)	51	12	295	107
Spencer (V)				
Waverly (V)	271	90	1,338	847
Tioga County	1682	585	9046	6250

Source: HAZUS-MH 2.0

Future Growth and Development

As discussed in Sections 4 and 9, areas targeted for future growth and development have been identified across the County. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. Current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards.

New development located in areas with softer NEHRP soil classes (D and E) may be more vulnerable to the earthquake hazard. Please note that because there was very little projected future development, a County-wide figure would not properly illustrate the new development in relation to the natural hazard boundaries. Please refer to the specific areas of development indicated in tabular form (subsection B) and/or on the hazard maps (subsection I) included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Additional Data and Next Steps

A Level 2 HAZUS-MH earthquake analysis was conducted for Tioga County using an updated critical facility inventory which included user-defined data and NEHRP soil data. Additional data needed to further refine the County’s vulnerability assessment include: (1) updated demographic and building stock data to update the default data in HAZUS-MH; (2) soil liquefaction data; and (3) a structure or building GIS layer to further identify vulnerable structures.

Overall Vulnerability Assessment

Earthquakes have an “occasional” probability of occurrence in the study area (hazard event is not likely to occur within 100 years) causing impacts and losses mainly to the Planning Area’s structures and facilities. Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The overall hazard ranking for this HMP for earthquake hazard is low (see Tables 5.3-3 through 5.3-6 in Section 5.3).