

5.3 HAZARD RANKING

As discussed in Section 5.2 (Identification of Hazards of Concern), a comprehensive range of natural hazards that pose a significant risk to Tompkins County were selected and considered during development of this plan; however, each community in Tompkins County has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the County and each participating jurisdiction can be found in their jurisdictional annexes in Volume II, Section 9 of this plan.

To this end, a hazard risk ranking process was conducted for Tompkins County and its municipalities using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and changing future conditions (climate change). Each were assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Tompkins County is described below. Estimates of risk for the County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool, and input from Tompkins County and participating jurisdictions. The ranking includes a factor to evaluate capacity of the participating jurisdiction regarding ability to address the hazard through plans, policies, and mitigation strategies.

shows the four risk assessment categories’ values for each of Tompkins County’s hazards. Details for each category are further described below.

Table 5.3-1. Summary of Hazard Ranking Approach

Category	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.	0	30%
	Rare	Between 1 and 10% annual probability of a hazard event occurring.	1	



Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		Occasional	Between 10 and 100% annual probability of a hazard event occurring.	2	
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14% or less of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	1	30%
		Medium	15% to 29% of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	2	
		High	30% or more of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14% or less of the total number of structures for community.	1	
		Medium	Property exposure is 15% to 29% of the total number of structures for community.	2	
		High	Property exposure is 30% or more of the total number of structures for community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9% or less of the total replacement cost for community.	1	
		Medium	Loss estimate is 10% to 19% of the total replacement cost for community.	2	
		High	Loss estimate is 20% or more of the total replacement cost for community.	3	
Capability		Low	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources;	3	30%



Category	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		limited capabilities to respond; long recovery.		
	Medium	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	2	
	High	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	1	
Climate Change	Low	No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
	Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
	High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well-documented and acceptable methods).	3	

5.3.1.1 Probability of Occurrence

The probability of occurrence is the likelihood of a hazard event occurring in any given year. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions described in



Table 5.3-2. The probability of occurrence is given a weighted value of 30%.

Table 5.3-2. Probability of Occurrence Ranking Factors

Numeric Value	Probability Category	Definition
0	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.
1	Rare	Between 1 and 10% annual probability of a hazard event occurring.
2	Occasional	Between 10 and 100% annual probability of a hazard event occurring.
3	Frequent	100% annual probability; a hazard event may occur multiple times per year.

5.3.1.2 Impact

The impact of each hazard is considered in three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and individual assessments by each participating municipality, an impact rating of high, medium, or low is assigned with a corresponding numeric value for each hazard of concern. In addition, a weighting factor is assigned to each impact category: 3 for population, 2 for property, and 1 for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard. The total of each category is assigned a weighted value of 30%. Table 5.3-3 presents the numerical rating, weighted factor and description for each impact category.

Table 5.3-3. Numerical Values and Definitions for Impacts on Population, Property and Economy

Category	Weighted Value	Low Impact* (1)	Medium Impact (2)	High Impact (3)
Population	3	14% or less of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	15% to 29% of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	30% or more of population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.
Property	2	Property exposure is 14% or less of the total number	Property exposure is 15% to 29% of the total number	Property exposure is 30% or more of the total



Category	Weighted Value	Low Impact* (1)	Medium Impact (2)	High Impact (3)
		of structures for community.	of structures for community.	number of structures for community.
Economy	1	Loss estimate is 9% or less of the total replacement cost for community.	Loss estimate is 10% to 19% of the total replacement cost for community.	Loss estimate is 20% or more of the total replacement cost for community.

Note: A numerical value of zero is assigned if there is no impact.

* For the purposes of this exercise, "impacted" means exposed for population and property and loss for economy.

5.3.1.3 Additional Impacts

Along with impacts on population, property, and economy, the overall risk ranking looks at two additional impacts that impact the County's vulnerability: capability and climate change. Table 5.3-4 presents the numerical rating and description for each category.

Capability

Capability refers to a jurisdiction's ability to protect the community from or withstand a hazard event. Mitigation measures are already in place, including codes/ordinances, plans, and procedures to withstand hazards due to design or location, deployable resources, or plans and procedures in place to respond to an event. The capability category has a weighted factor of 30%.

Climate Change

Climate change refers to the impact that climate change projections have on increasing or decreasing the severity and frequency of a hazard. The climate change category has a weighted factor of 10%.

Table 5.3-4. Numerical Values and Definitions for Adaptive Capacity and Changing Future Conditions

Category	Low Impact*	Medium Impact	High Impact
Capability	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.
Climate Change	No local data is available; modeling projects are uncertain on whether there is increased future risk;	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very



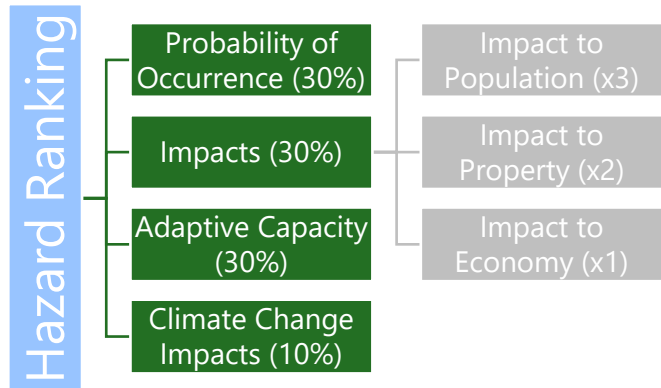
Category	Low Impact*	Medium Impact	High Impact
	confidence level is low (inconclusive evidence).	(suggestive to moderate evidence).	high confidence level (strong evidence, well-documented and acceptable methods).

Note: *Low impact for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability; whereas high impact for adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability.*

5.3.1.4 Risk Ranking Value

Each impact was then weighted and the risk ranking for each hazard is then calculated using the following formula.

Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = values less than 3.5; Medium = values between 3.5 and 4.5; High = values greater than 4.5.



Example Risk Ranking Equation

$$\text{Risk Ranking} = [(\text{Impact on Population} \times 3) + (\text{Impact on Property} \times 2) + (\text{Impact on Economy} \times 1) \times 30\%] + [\text{Capability} \times 30\%] + [\text{Climate Impact} \times 10\%] + [\text{Probability of Occurrence} \times 30\%]$$

5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Tompkins County. The hazard ranking for Tompkins County is detailed in the subsequent tables that present the step-wise process for the ranking. The Countywide risk ranking includes the entire planning area and might not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each municipality indicate the differing degrees of risk exposure and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. Both the County and the participating jurisdictions have applied the same methodology to develop the Countywide risk and local rankings to ensure consistency in the overall ranking of risk, jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves four purposes:



1. To describe the probability of occurrence for each hazard;
2. To describe the impact each would have on the people, property, and economy;
3. Evaluate the capabilities a community has with regards to natural hazards; and
4. To consider changing future conditions (i.e., climate change) in Tompkins county.

Estimates of risk for Tompkins County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool and input from the County and participating municipalities. Table 5.3-5 shows the probability ranking assigned for likelihood of occurrence for each hazard.

Table 5.3-5. Probability of Occurrence Ranking for Hazards of Concern for Tompkins County









Hazard of Concern	Probability	Numeric Value
 Disease Outbreak	Occasional	2
 Drought	Occasional	2
 Extreme Temperatures	Frequent	3
 Flood	Occasional	2
 Invasive Species	Occasional	2
 Harmful Algal Bloom	Occasional	2
 Severe Storm	Frequent	3
 Severe Winter Storm	Frequent	3

Table 5.3-6 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the County level. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide. Jurisdictional ranking results are presented in each local annex in Section 9 (Jurisdictional Annexes) of this plan. The weighting factor results and a total impact for each hazard also are summarized.



Table 5.3-6. Impact Ranking for Hazards of Concern for Tompkins County

Hazard of Concern	Impact	Population		Impact	Property		Impact	Economy		Total Impact Rating (Population + Property + Economy)
		Numeric Value	Multiplied by Weighing Factor (3)		Numeric Value	Multiplied by Weighing Factor (2)		Numeric Value	Multiplied by Weighing Factor (1)	
Disease Outbreak	Medium	2	6	Low	1	2	Medium	2	2	10
Drought	Low	1	3	High	3	6	Medium	2	2	11
Extreme Temperatures	Medium	2	6	Low	1	2	Low	1	1	9
Flood	Medium	2	6	Medium	2	4	Medium	2	2	12
Invasive Species	Low	1	3	Medium	2	4	Medium	2	2	9
Harmful Algal Bloom	Medium	2	6	Low	1	2	Medium	2	2	10
Severe Storm	High	3	9	Low	1	2	Low	1	1	12
Severe Winter Storm	Medium	2	6	Low	1	2	Low	1	1	9



Table 5.3-7 shows the additional impact rankings for the hazards of concern. This includes the overall capabilities of the County and municipalities and the consideration of changing future conditions, such as climate change.

Table 5.3-7. Additional Impact Ranking for Hazards of Concern for Tompkins County

Hazard of Concern	Adaptive Capacity	Numeric Value	Climate Change	Numeric Value
Disease Outbreak	2	0.6	2	0.2
Drought	2	0.6	3	0.3
Extreme Temperatures	2	0.6	3	0.3
Flood	2	0.6	3	0.3
Invasive Species	2	0.6	2	0.2
Harmful Algal Bloom	2	0.6	2	0.2
Severe Storm	2	0.6	3	0.3
Severe Winter Storm	1	0.3	2	0.2

Table 5.3-8 presents the total calculations for each hazard ranking value for the hazards of concern.

Table 5.3-8. Total Hazard Ranking Values for the Hazards of Concern for Tompkins County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Climate Change x 10%	Total Risk Ranking Value
Disease Outbreak	0.6	3.0	0.6	0.2	4.4
Drought	0.6	3.3	0.6	0.3	4.8
Extreme Temperatures	0.9	2.7	0.6	0.3	4.5
Flood	0.6	3.6	0.6	0.3	5.4
Invasive Species	0.6	2.7	0.6	0.2	4.1
Harmful Algal Bloom	0.6	3.0	0.6	0.2	4.1
Severe Storm	0.9	3.6	0.6	0.3	5.4
Severe Winter Storm	0.9	2.7	0.3	0.2	4.1









Low = values less than 3.5 (yellow); Medium = values between 3.5 and 4.5 (amber); High = values greater than 4.5 (red).



Table 5.3-9 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories, low, medium, and high. It also includes input by the municipalities. The rankings were categorized as follows: Low = values less than 3.5 colored yellow; Medium = values between 3.5 and 4.5 colored amber; High = values greater than 4.5 colored red.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Section 9 (Jurisdictional Annexes) of this plan. The summary rankings for the County reflect the results of the vulnerability analysis for each hazard of concern and can vary from the specific results of each jurisdiction. For example, the severe storm hazard may be ranked low in one jurisdiction, but due to the exposure and impact countywide, it is ranked as a high hazard and is addressed in the County mitigation strategy accordingly.

Table 5.3-9. Summary of Preliminary Overall Ranking of Natural Hazards by Jurisdiction

Tompkins County Municipalities	Disease Outbreak 	Drought 	Extreme Temperature 	Flood 	Invasive Species 	Harmful Algal Bloom 	Severe Storm 	Severe Winter Storm 
Caroline, T	Medium	High	Medium	High	Medium	Low	High	Medium
Cayuga Heights, V	Medium	Medium	Medium	Medium	Medium	Medium	High	Medium
Danby, T	Medium	High	Medium	Low	Medium	Low	High	Medium
Dryden, T	Medium	High	Medium	High	Medium	Medium	High	Medium
Dryden, V	Medium	Medium	Medium	High	Medium	Medium	High	Medium
Enfield, T	Medium	High	Medium	Low	Medium	Low	High	Medium
Freeville, V	Low	Medium	Medium	High	Low	Low	High	Medium
Groton, T	Medium	High	Medium	High	Medium	Low	High	Medium
Groton, V	Medium	Medium	Medium	High	Medium	Low	High	Medium
Ithaca, C	Medium	Medium	Medium	High	Medium	Medium	High	Medium
Ithaca, T	Medium	High	Medium	High	Medium	Medium	High	Medium
Lansing, T	Medium	High	Medium	High	Medium	Medium	High	Medium
Lansing, V	Medium	Medium	Medium	Medium	Medium	Medium	High	Medium
Newfield, T	Medium	High	Medium	High	Medium	Low	High	Medium
Trumansburg, V	Medium	Medium	Medium	Low	Medium	Low	High	Medium
Ulysses, T	Medium	High	Medium	Low	Medium	Medium	High	Medium
Tompkins County	Medium	High	Medium	High	Medium	Medium	High	Medium

Low = Values less than 4; Medium = Values between 4 and 5; High = Values greater than 5.1.

