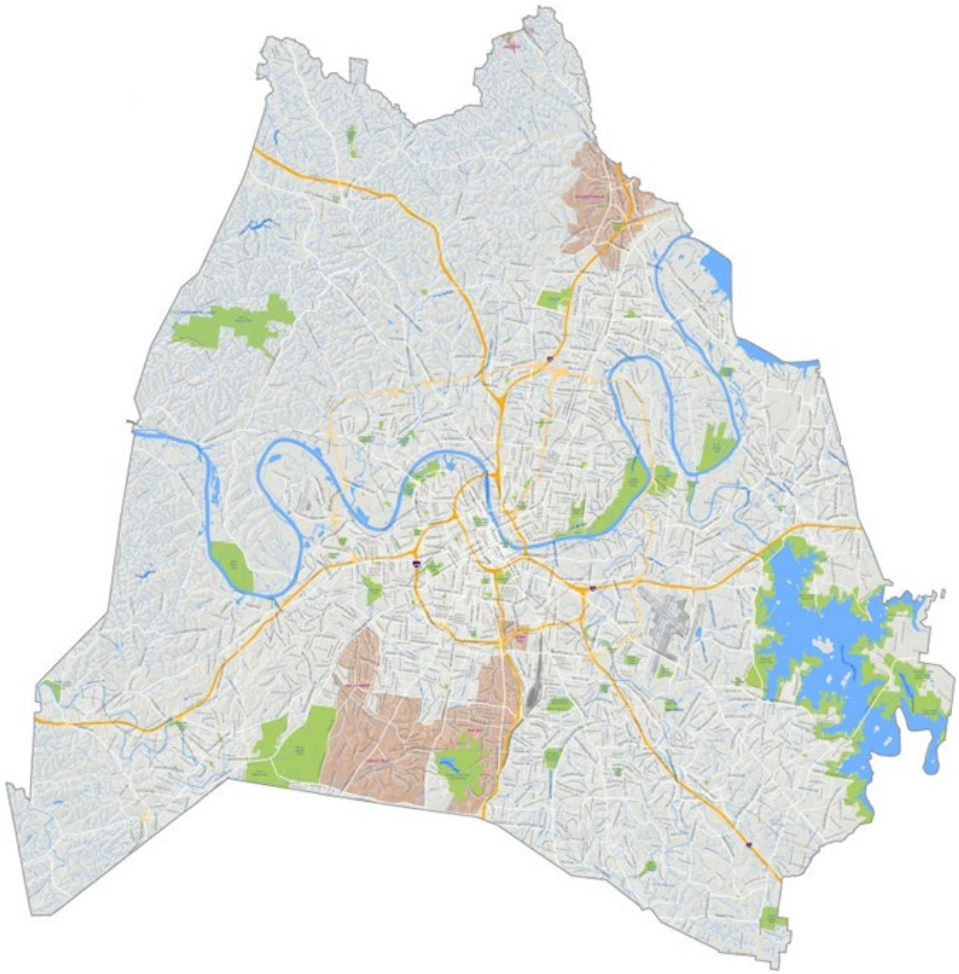
NASHVILLE – DAVIDSON COUNTY

Threat and Hazard Identification and Risk Assessment (THIRA)

April 2023
FINAL



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EXECUTIVE SUMMARY

The risk assessment process provides information that allows a community to better understand its potential risk and associated vulnerability to natural and man-made hazards. This information provides the framework for a community to develop and prioritize mitigation strategies and to implement plans to help reduce both the risk and vulnerability from future hazard events. The risk assessment for Metropolitan Nashville-Davidson County followed methodology from the Federal Emergency Management Agency (FEMA) and the Emergency Management Accreditation Program (EMAP). This assessment process was conducted by the Nashville-Davidson County Multi-Hazard Mitigation Community Planning Team (CPT) and select subject matter experts.

The agencies that took part in this 2023 THIRA process included:

- City of Belle Meade
- City of Berry Hill
- City of Goodlettsville
- Metro Codes
- Metro ITS - GIS
- Metro Planning
- Metro Police
- Metro Public Health
- Metro Schools
- Metro Storm Water
- Metro Water
- Nashville Dept of Transportation
- Nashville Electric Service
- Nashville Fire
- Nashville Office of Emergency Management
- National Weather Service
- TN Geological Survey
- TN State University
- Vanderbilt University

Risk from natural and man-made hazards is measured by a combination of impact, vulnerability and likelihood scores (Impact + Vulnerability x Likelihood = Risk). The impact and vulnerability scores were given the below parameters resulting from a hazard event:

- Geographic Extent
- Duration of the Event
- Environment
- Health Effects
- Displacement and Suffering
- Economy
- Infrastructure
- Transportation
- Critical Services
- Confidence in Government
- Cascading Effects

For each hazard identified, each agency on the CPT gave a score for each of the parameters, and then all the scores were added together to get an overall total Impact and Vulnerability Assessment Score.

Weighted scores were conducted where extra counts were given for the following lead agencies and associated hazards: National Weather Service for all weather-related hazards, Public Health for Communicable Diseases, TN Geological Survey for Earthquakes & Landslides/sinkholes, Nashville Electric Service for Earthquakes, Police for Man-made –Technological/Terrorism, and Fire for Hazardous Materials and Wildfire.

Comparing this assessment (2023) to the last assessment completed in 2019, there is one new hazard in the top 5 list, and that is Communicable Diseases. This makes sense since the last assessment was completed prior to the Coronavirus outbreak that surfaced in late 2019-2020. This caused Extreme Temperatures to be bumped down under Thunderstorms but is still close as number 6 on the list.

There are also a few other minor changes to the list as you can see below.

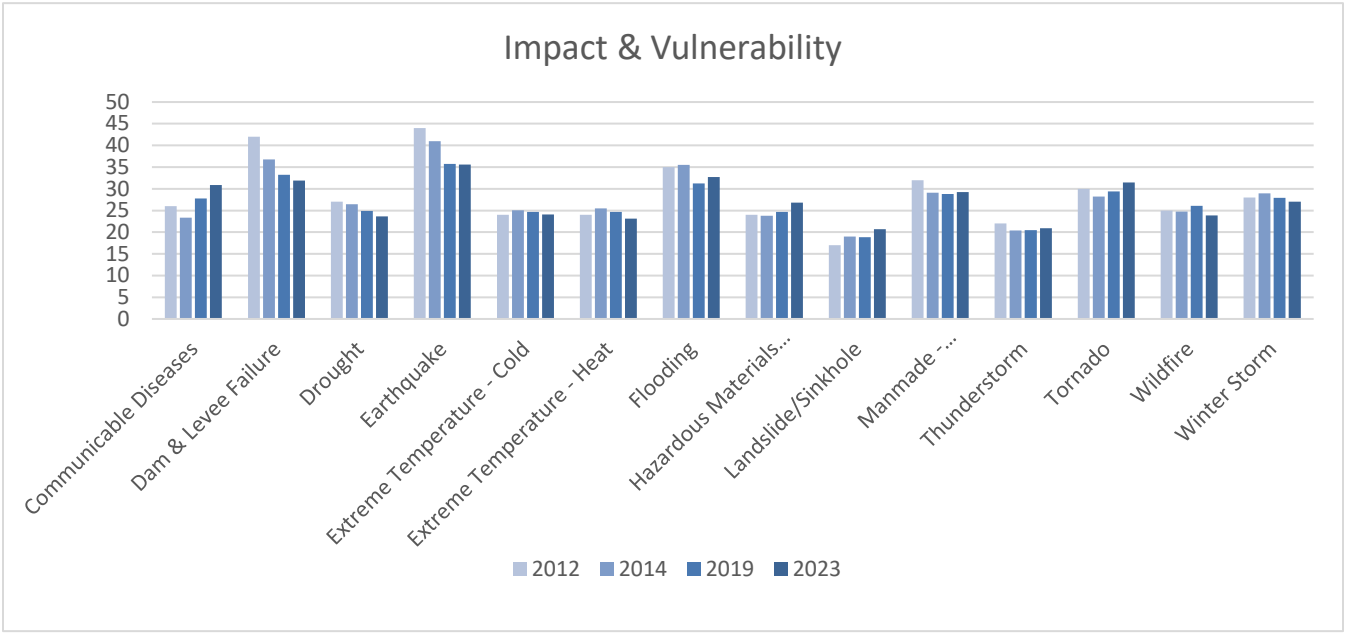
2023	2019
1. Flooding	**1. Flooding**
2. Tornado	**2. Tornado**
3. Winter Storm	**3. Winter Storm**
4. Communicable Diseases	**4. Extreme Temperatures (Heat/Cold)**
5. Thunderstorm	**5. Thunderstorm**
6. Extreme Temperatures (Heat/Cold)	**6.** Hazardous Materials Incident
7. Manmade – Technological/Terrorism	**7.** Communicable Diseases
8. Hazardous Materials Incident	**8.** Drought
9. Drought	**9.** Manmade – Technological/Terrorism
10. Landslide/Sinkhole	**10.** Dam & Levee Failure
11. Wildfire	**11.** Wildfire
12. Dam & Levee Failure	**12.** Landslide/Sinkhole
13. Earthquake	**13.** Earthquake

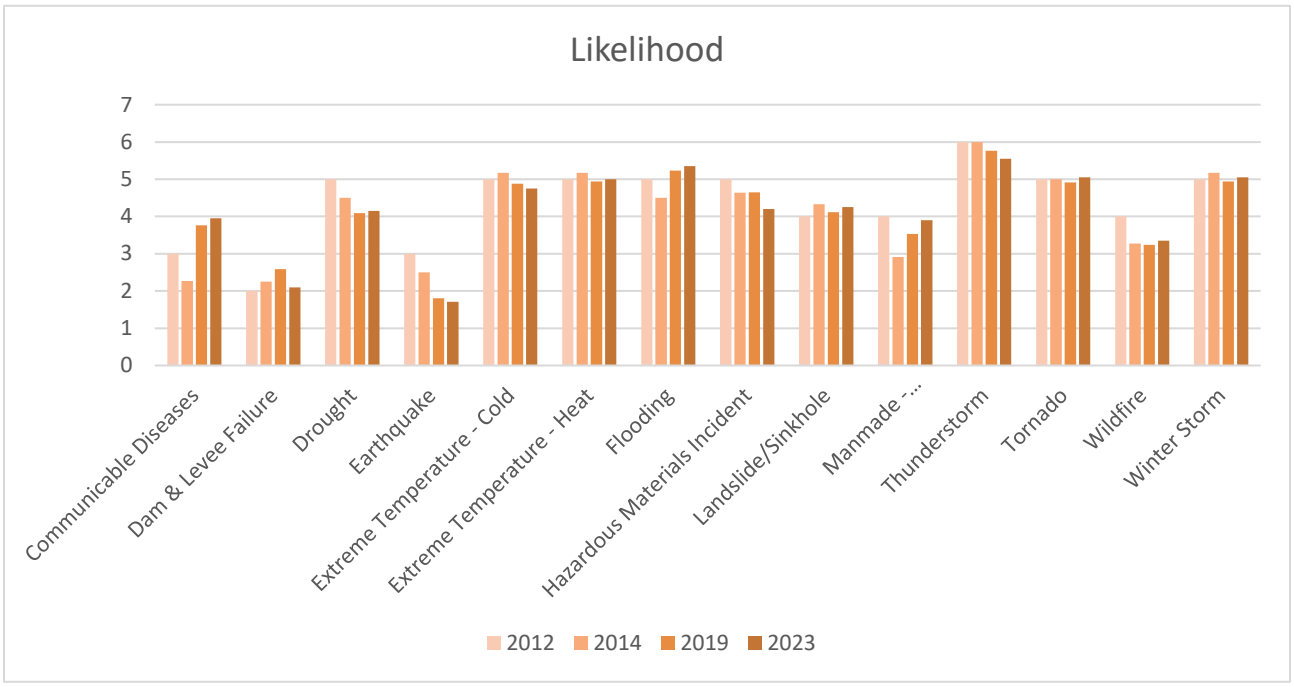
Besides the Coronavirus that surfaced in late 2019-2020, many other incidents transpired since the last assessment in 2019, this includes, but is not limited to:

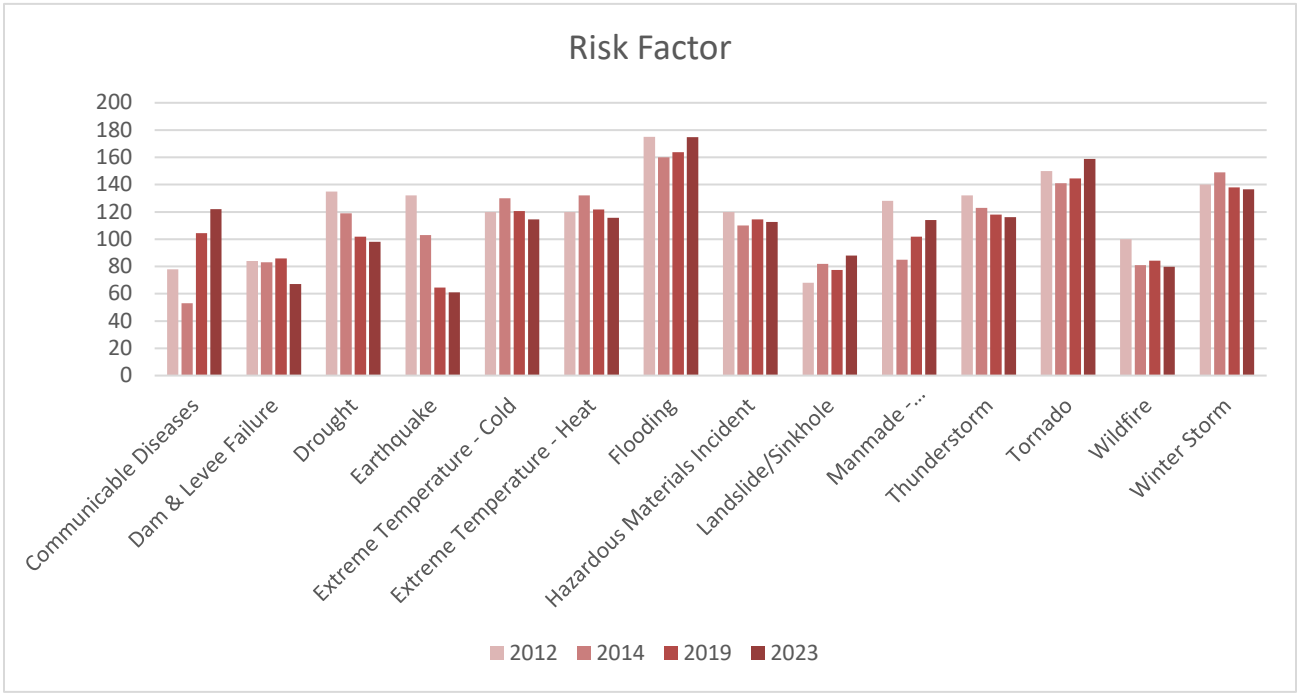
- Tornadoes
- Derecho
- High wind events
- Civil Unrest and similar
- Drought
- Major Flooding incidents
- Bombing downtown
- Winter storms

Lastly, another possible explanation to the changes in this THIRA could relate to the large population and building increases that have happened over the past few years in Davidson County, causing the Impact & Vulnerability scores to change.

Following are graphs showing how each of the hazards have changed since 2012 in Impact & Vulnerability, Likelihood, and the Overall Risk Factor.




Likelihood
7
6
5
4
3
2
1
0
Communicable Diseases
Dam & Levee Failure
Drought
Earthquake
Extreme Temperature - Cold
Extreme Temperature - Heat
Flooding
Hazardous Materials Incident
Landslide/Sinkhole
Manmade -...
Thunderstorm
Tornado
Wildfire
Winter Storm
2012
2014
2019
2023


Risk Factor
200
180
160
140
120
100
80
60
40
20
0
Communicable Diseases
Dam & Levee Failure
Drought
Earthquake
Extreme Temperature - Cold
Extreme Temperature - Heat
Flooding
Hazardous Materials Incident
Landslide/Sinkhole
Manmade -...
Thunderstorm
Tornado
Wildfire
Winter Storm
2012
2014
2019
2023

FINAL SCORING RESULTS

OVERALL Impact & Vulnerability Assessment Scores 2023	Geographical Extent	Duration	Environment	Health Effects	Displacement	Economy	Built Environment	Transportation	Critical Services	Confidence in Govt	Cascading Effects	
Hazard	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**
Dam & Levee Failure	3.33	3.11	3.00	2.50	2.83	2.78	3.11	3.06	2.44	2.94	2.78	31.89
Flooding	3.35	3.20	2.95	2.55	3.15	2.90	3.40	3.05	2.75	2.58	2.80	32.68
Earthquake	4.10	3.57	2.48	3.05	3.33	3.29	3.81	3.57	2.86	2.30	3.24	35.59
Landslide/Sinkhole	1.30	2.70	2.60	1.75	1.80	1.80	2.00	2.15	1.50	1.47	1.60	20.67
Communicable Diseases	4.40	4.35	1.70	3.95	2.20	2.65	1.40	1.80	2.50	3.42	2.50	30.87
Drought	4.45	4.50	2.75	1.60	1.50	1.65	1.10	1.15	1.50	1.42	2.00	23.62
Wildfire	2.85	2.25	2.95	2.00	2.30	2.05	2.15	2.00	1.60	1.74	1.95	23.84
Extreme Temperature - Cold	4.50	2.70	1.95	2.05	2.20	2.00	1.80	1.50	1.85	1.58	1.95	24.08
Extreme Temperature - Heat	4.50	2.75	2.00	2.10	1.95	1.80	1.45	1.20	1.70	1.58	2.10	23.13
Thunderstorm	3.30	1.55	1.95	1.75	2.00	1.85	1.90	1.70	1.70	1.37	1.85	20.92
Tornado	3.45	2.55	2.95	2.60	3.30	2.95	3.00	2.90	2.75	2.11	2.90	31.46
Winter Storm	4.70	2.75	1.90	1.95	2.05	2.00	1.70	3.25	2.55	1.95	2.25	27.05
Manmade - Technological/Terrorism	3.30	2.80	2.20	2.65	2.65	2.80	2.20	2.45	2.55	3.32	2.35	29.27
Hazardous Materials Incident	2.55	2.55	3.50	2.20	2.65	2.25	1.95	2.05	2.05	2.68	2.40	26.83

OVERALL Total Risk Scores for Davidson County 2023			
Hazard	**Impact & Vulnerability**	**x Likelihood**	**= Risk Factor**
Flooding	32.68	5.35	**174.8**
Tornado	31.46	5.05	**158.8**
Winter Storm	27.05	5.05	**136.6**
Communicable Diseases	30.87	3.95	**121.9**
Thunderstorm	20.92	5.55	**116.1**
Extreme Temperature - Heat	23.13	5.00	**115.6**
Extreme Temperature - Cold	24.08	4.75	**114.4**
Manmade - Technological/Terrorism	29.27	3.90	**114.1**
Hazardous Materials Incident	26.83	4.20	**112.7**
Drought	23.62	4.15	**98.0**
Landslide/Sinkhole	20.67	4.25	**87.9**
Wildfire	23.84	3.35	**79.9**
Dam & Levee Failure	31.89	2.10	**67.0**
Earthquake	35.59	1.71	**61.0**

PARAMETERS

Impact & Vulnerability Parameters						
Parameter	***Definition***	***1***	***2***	***3***	***4***	***5***
Geographic Extent	Size of the affected area. Includes areas not damaged but strongly affected by the incidents. For example, areas backed up by a transportation accident.	Single site. One or two blocks.	Single site. Multiple blocks.	Community (downtown, Berry Hill)	City-wide	Regional. (Winter Storms.)
Duration	How long does the acute crisis part of the disaster last?	Less than 24 hours	1-3 days	4-7 days	7-30 days	30+ days
Environment	How damaging is the disaster for the natural environment?	No damage/ temporary minor damage	Degradation of ecosystem that will repair itself	Degradation of ecosystem that requires intervention	Functional loss of ecosystem, but restoration is possible	Permanent loss of ecosystem
Health Effects (Deaths and Injuries)	How dangerous is the disaster for the natural environment?	No deaths or injuries	1-10 deaths and/or 1-100 injuries	11-50 deaths and/or 101-500 injuries	51-500 deaths and/or 501-1500 injuries	Over 501 deaths and/or 1501 injuries
Displacement and Suffering	How likely is the hazard to negatively impact the exposed population in terms of displacement, personal property loss and increased indebtedness?	No displaced people	Vulnerable populations begin to have problems with food, water, access to shelter.	Vulnerable populations having serious difficulties. General population starting to have problems.	251-1000 people displaced. 5-30% of population facing acute shortages.	1000+ displaced people. More than 30% of population facing acute shortages of basic supplies and access to services.
Economy	How does the hazard affect the local economy?	No measurable impacts	No impacts to overall economy but isolated businesses experience hardship.	Entire sectors experience loss of revenue and capital.	Core sectors of economy are affected and unable to generate revenue. Capital losses between 1-10%	Physical losses equal to 10% to assess value. Loss of ability to generate revenue.
Built Environment (Property, Facilities, Infrastructure)	How does the hazard affect buildings and physical infrastructure? (Includes utilities)	No effects.	1-10 structures uninhabitable (red tagged). Up to 25% loss of one utility.	11-250 structures red tagged. Multiple utilities affected up to 25%.	251-1000 structures red tagged. Multiple utilities affected 25-50%.	1000+ structures red tagged. At least two major utilities degraded at least 50%.
Transportation	How does the hazard affect the ability of residents and workers to access the resources they need?	No effects on mobility	All critical services accessible, but delays reaching work or non essential services	One critical service inaccessible. Degradation of at least one mode. Major corridors open, but minor streets degraded or impassible.	Many critical services inaccessible. One major mode inoperable. One major corridor inoperable.	Most critical services inaccessible. Multiple modes inoperable. Most high volume corridors impassible.
Critical Services (Continuity of Operations and Responders)	How likely is the hazard to reduce the ability of government and business to provide critical services? (Medical, Public Safety, Social, Financial, etc)	No impairment on critical services	Temporary degradation of 1 critical service	Temporary degradation of multiple critical services. Long term degradation of 1 critical service	Temporary degradation of most critical services. Long term degradation of multiple services.	Unable to deliver most critical services.
Confidence in Government	Would public's confidence in government be shaken?	No	(Not used)	Somewhat	(Not used)	Yes
Cascading Effects	How severe and complex will the secondary effects be?	Hazard extremely unlikely to cause secondary hazards. If they occur, would have minor effect.	Secondary hazards may occur, but are likely to be minor compared to primary hazard	Secondary hazards occur that extend the impact of the disaster and hamper response, but are not disasters in their own right.	Secondary effects generated that significantly increase the magnitude of the disaster. Secondary impacts would likely be considered disasters if they occurred by themselves.	Secondary effects generated and rival or exceed primary hazard. Secondary impacts would definitely be disasters in their own right.

Hazard Likelihood Parameters		
Measure of likelihood	**Return period in years**	**Rank**
Frequent or very likely	Every 1-3 years	**6**
Moderate or likely	Every 3-10 years	**5**
Occasional, slight chance	Every 10-30 years	**4**
Unlikely, improbable	Every 30-100 years	**3**
Highly unlikely, rare event	Every 100-200 years	**2**
Very rare event	Every 200-300 years	**1**

METHODOLOGY EXPLANATION	
FREQUENT OR VERY LIKELY	Frequent or very likely to occur events usually have a high number of recorded incidents or anecdotal evidence. *(For example, an area that is subject to flooding every year or so)*
MODERATE OR LIKELY	Moderate or likely to occur hazards also have a historical record but occur with a frequency of 3-10 years. *(For example, an area that faces an infectious disease outbreak every few years)*
OCCASIONAL OR SLIGHT CHANCE	Occasional or slight chance means events are those that occur infrequently. There may be little recorded historical evidence and a return interval of 10-30 years. *(For example, a rail accident where dangerous chemicals are released)*
UNLIKELY OR IMPROBABLE	Unlikely or improbable refers to hazards that are not expected to occur more frequently than once every 30-100 years. There may be no historical incidents in the community. *(For example, a plane crash with total loss of life)*
HIGHLY UNLIKELY OR RARE	Highly unlikely or rare events are extremely unlikely and have a return period of 100-200 years. *(For example, a —one hundred year flood)*
VERY RARE EVENTS	Very rare events may happen every 200+ years. *(For example, a large earthquake)*

These two scores are then multiplied to give a risk factor in the next table:

Impact and Vulnerability Assessment x Hazard Likelihood = Risk