Hazard Mitigation Plan

Prepared for:

Monroe County Office of Emergency Management

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Certification of Annual Review Meetings

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2021			
2022			
2023			
2024			
2025			

**Confirm yes here annually and describe on record of change page.*

Record of Changes

DATE	DESCRIPTION OF CHANGE MADE, MITIGATION ACTION COMPLETED, OR PUBLIC OUTREACH PERFORMED	CHANGE MADE BY (PRINT NAME)	CHANGE MADE BY (SIGNATURE)

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Executive Summary

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Hazard mitigation focuses attention and resources on county and municipal policies and actions that will produce successive benefits over time. State and local governments engage in hazard mitigation planning to identify risks and vulnerabilities associated with natural as well as human-caused hazards and develop long-term strategies for protecting people and property from future hazard events. Mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage. This plan represents the work of citizens, elected and appointed government officials, business leaders, and volunteer and nonprofit groups to protect community assets, preserve the economic viability of the community, and save lives.

In 2021, Monroe County Office of Emergency Management contracted the services of a consulting agency to revise and update the Monroe County Hazard Mitigation Plan. The plan was successfully updated in accordance with the requirements set forth by PEMA and FEMA. The updated Monroe County Hazard Mitigation Plan was adopted by the Monroe County Commissioners in 2021. All twenty municipalities adopted the 2016 Monroe County Hazard Mitigation Plan as the municipal hazard mitigation plan, and it is anticipated that all participating municipalities will adopt the 2021 Monroe County Hazard Mitigation Plan Update.

The Monroe County Commissioners secured a grant to complete the 2021 update to the Monroe County Hazard Mitigation Plan. MCM Consulting Group, Inc. was hired to assist the county with the update of the plan. The planning kick-off meeting was conducted January 8th, 2021.

The planning process for the 2021 Monroe County Hazard Mitigation Plan Update consisted of the following:

- Identification and prioritization of the hazards that may affect the county and its municipalities.
- Assessment of the county's and municipalities' vulnerability to these hazards.
- Identification of the mitigation actions and projects that can reduce that vulnerability.
- Development of a strategy for implementing the actions and projects, including identifying the agency(ies) responsible for that implementation.

Throughout the planning process, the general public was given the opportunity to comment on the existing HMP and provide suggestions for the updated version. Due to COVID-19, public meetings were conducted via an online survey to provide residents an opportunity to provide input on the HMP. Several meetings were held virtually, and participants were invited to submit surveys and other documents via an online survey.

The following hazards were identified by the local planning team as presenting the highest risk to the county and its municipalities:

- Drought
- Earthquake
- Extreme Temperatures
- Flooding, Flash Flooding, and Ice Jam Flooding
- Hurricane/Tropical Storm
- Invasive Species
- Pandemic and Infectious Disease
- Tornado/Windstorm
- Wildfire
- Winter Storms/Nor'easter
- Dam Failure
- Disorientation
- Drowning
- Emergency Services Shortage
- Environmental Hazards/Hazardous Materials
- Levee Failure
- Nuclear Incidents
- Opioid/Substance Abuse
- Terrorism/Cyber Terrorism
- Transportation Accidents
- Utility Interruptions

A total of twenty-two hazards have been identified in the 2021 Monroe County Hazard Mitigation Plan. A total of nineteen identified hazards were listed in the previous 2016 plan update. The three new hazards for the 2021 plan are cyber terrorism/incidents, emergency services shortage, and opioid/substance abuse.

To mitigate against the effects of these hazards, the local planning team identified the following goals for hazard mitigation over the next five years:

- Reduce potential injury/death and damage to existing community assets due to floods, flash floods, and ice jams.
- Reduce potential injury/death and damage to existing community assets due to all hazards.
- Promote disaster-resistant future development.
- Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.
- Improve response and recovery capabilities.
- Protect critical infrastructure.

Mitigation actions are specific projects and activities that help achieve goals. A total of fifty-six actions were developed for this plan update as they pertain to hazards identified by the local planning team. The 2016 Monroe County Hazard Mitigation Plan consisted of thirty-nine total actions. The individual objectives and actions that will be implemented are shown in Section 6.4. Each municipality was provided the opportunity to submit new project opportunity forms for this update. A total of fifty-six project opportunity forms were submitted during the 2016 HMP update. Municipalities were asked to indicate the current status of these projects submitted in 2016, of which zero indicated any completed projects. A total of fifty-three project opportunities were submitted for this plan update.

The 2021 Monroe County Hazard Mitigation Plan is the cornerstone to reducing Monroe County's vulnerability to disasters. It is the commitment to reducing risks from hazards and serves as a guide for decision makers as they commit resources to reducing the effects of hazards. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage.

The 2021 Monroe County Hazard Mitigation Plan is a living document that reflects ongoing hazard mitigation activities and requires monitoring, evaluating, and updating to ensure the mitigation actions are implemented. To facilitate the hazard mitigation planning process and adhere to regulatory requirements, the plan will be reviewed annually, and any major revisions will be incorporated into the five-year update.

1. Introduction

1.1. Background

The Monroe County Board of Commissioners, in response to the Disaster Mitigation Act of 2000 (DMA 2000), organized a countywide hazard mitigation planning effort to prepare, adopt and implement a multi-jurisdictional Hazard Mitigation Plan (HMP) for Monroe County and all of its twenty municipalities. Monroe County Office of Emergency Management and Monroe County Planning Commission was charged by the County Board of Commissioners to prepare the 2021 plan. The 2016 HMP has been utilized and maintained during the five-year life cycle.

The Monroe County Commissioners were successful in securing hazard mitigation grant funding to update the county hazard mitigation plan. The pre-disaster mitigation grant funding was administered by the Pennsylvania Emergency Management Agency and provided to Monroe County as a sub-grantee. The Monroe County Commissioners assigned the Monroe County Office of Emergency Management with the primary responsibility to update the hazard mitigation plan. MCM Consulting Group, Inc. was selected to complete the update of the HMP. A local hazard mitigation planning team was developed comprised of government leaders and citizens from Monroe County. This updated HMP will provide another solid foundation for the Monroe County Hazard Mitigation Program.

Hazard mitigation describes sustained actions taken to prevent or minimize long-term risks to life and property from hazards and to create successive benefits over time. Pre-disaster mitigation actions are taken in advance of a hazard event and are essential to breaking the disaster cycle of damage, reconstruction and repeated damage. With careful selection, successful mitigation actions are cost-effective means of reducing risk of loss over the long term.

Hazard mitigation planning has the potential to produce long-term and recurring benefits. A core assumption of mitigation is that current dollars invested in mitigation practices will significantly reduce the demand for future dollars by lessening the amount needed for recovery, repair and reconstruction. These mitigation practices will also enable local residents, businesses, and industries to reestablish themselves in the wake of a disaster, getting the economy back on track sooner and with less interruption.

1.2. Purpose

The purpose of this all-hazard mitigation plan (HMP) is:

- Protect life, safety, and property by reducing the potential for future damages and economic losses that result from hazards.
- Qualify for additional grant funding, in both the pre-disaster and the post-disaster environment.

- Speed recovery and redevelopment following future disaster events.
- Demonstrate a firm local commitment to hazard mitigation principles.
- Comply with both state and federal legislative requirements for local hazard mitigation plans.

1.3. Scope

This Monroe County Multi-Jurisdictional Hazard Mitigation Plan serves as a framework for saving lives, protecting assets and preserving the economic viability of the twenty municipalities in Monroe County and East Stroudsburg University (ESU). The HMP outlines actions designed to address and reduce the impact of a full range of natural hazards facing Monroe County, including drought, earthquakes, flooding, tornadoes, hurricanes/tropical storms, invasive species, and severe winter weather. Human-caused hazards such as transportation accidents, emergency services shortage, hazardous materials spills, and fires are also addressed.

A multi-jurisdictional planning approach was utilized for the Monroe County HMP update, thereby eliminating the need for each municipality to develop its own approach to hazard mitigation and its own planning document. Further, this type of planning effort results in a common understanding of the hazard vulnerabilities throughout the county, a comprehensive list of mitigation projects, common mitigation goals and objectives and an evaluation of a broad capabilities assessment examining policies and regulations throughout the county and its municipalities.

1.4. Authority and References

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended
- Code of Federal Regulations (CFR), Title 44, Parts 201 and 206
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended.
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 et seq.
- Authority for this plan originates from the following Commonwealth of Pennsylvania sources:
- Pennsylvania Emergency Management Services Code. Title 35, Pa C.S. Section 101
- Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988.
- Pennsylvania Stormwater Management Act of October 4, 1978. P.L. 864, No. 167

The following Federal Emergency Management Agency (FEMA) guides and reference documents were used to prepare this document:

- FEMA 386-1: Getting Started. September 2002
- FEMA 386-2: Understanding Your Risks: Identifying Hazards and Estimating Losses. August 2001
- FEMA 386-3: Developing the Mitigation Plan. April 2003
- FEMA 386-4: Bringing the Plan to Life. August 2003
- FEMA 386-5: Using Benefit-Cost Review in Mitigation Planning. May 2007
- FEMA 386-6: Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning. May 2005
- FEMA 386-7: Integrating Manmade Hazards into Mitigation Planning. September 2003
- FEMA 386-8: Multijurisdictional Mitigation Planning. August 2006
- FEMA 386-9: Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects. August 2008
- FEMA Local Multi-Hazard Mitigation Planning Guidance. July 1, 2008
- FEMA National Fire Incident Reporting System 5.0: Complete Reference Guide. January 2008
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. January 2013
- FEMA Rehabilitation of High Hazard Potential Dams: Grant Program Guidance, June 2020

The following Pennsylvania Emergency Management Agency (PEMA) guides and reference documents were used to prepare this document:

- PEMA: Hazard Mitigation Planning Made Easy!
- PEMA Mitigation Ideas: Potential Mitigation Measures by Hazard Type: A Mitigation Planning Tool for Communities. March 6, 2009
- PEMA: All-Hazard Mitigation Planning Standard Operating Guide, 2020.

The following document produced by the National Fire Protection Association (NFPA) provided additional guidance for updating this plan:

- NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs. 2011

2. Community Profile

2.1. Geography and the Environment

Monroe County is located in the northeastern region of Pennsylvania, sharing part of its eastern border with New Jersey. The county has a total land area of approximately 617 square miles with nine square miles being water. Monroe County shares a border with Northampton County to the south; Wayne County to the north; Carbon, Luzerne, and Lackawanna Counties to the west and Pike County to the east in Pennsylvania; and Warren and Sussex Counties in New Jersey to the east. A base map of the county is provided in *Figure 2 – Monroe County Base Map*. While most of the county is considered rural, East Stroudsburg was classified as an urban area by the 2010 United States Census. Overall, the United States Center for Disease Control and Prevention (CDC) classified the county as a "small metro" county in 2013, meaning that the county is in an "MSA of less than 250,000 population." This classification is a four on a scale from one to six, with six being the most rural and one being the most urban (CDC, 2013).

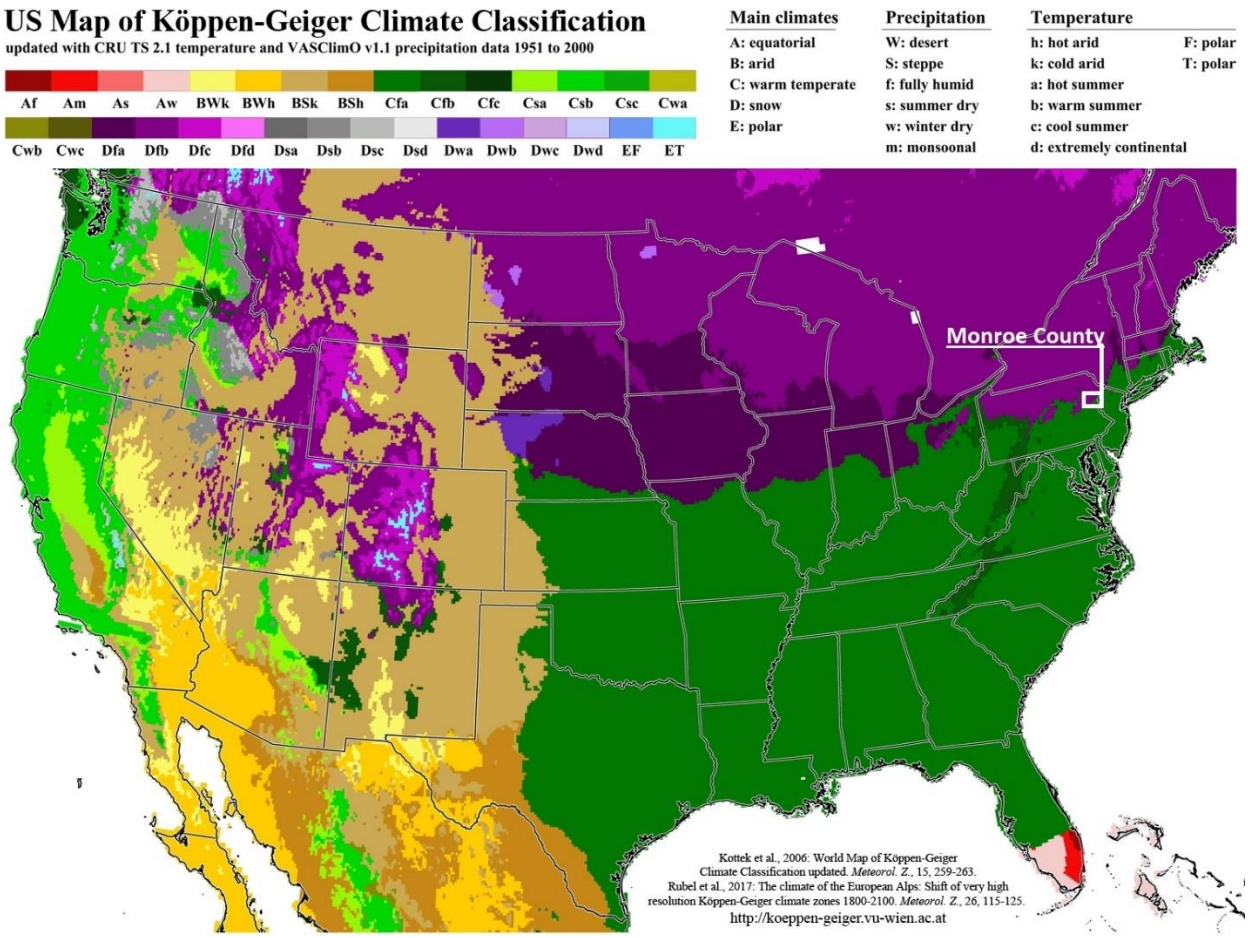
Monroe County is bordered on the east side by the Delaware River, on the west side by the Lehigh River, and on the south side by a ridge of the Blue Mountains. Almost 7% of the land is developed, and the undeveloped land mostly contains wooded peaks and valleys. In 1999, Monroe County enacted a comprehensive plan intended to maintain the pristine environment of the county. The plan was updated in 2014. Monroe County contains part of the Delaware Water Gap National Recreation Area which averages four million visitors per year. Monroe County is also home to Big Pocono State Park and Tobyhanna State Park.

There are thirty-one small watersheds and four large watersheds in Monroe County, including the watersheds for the Delaware and Lehigh Rivers. The largest of the watersheds is the Middle Delaware Mongaup-Brodhead watershed. *Figure 3 - Monroe County Small Watersheds* illustrates the watersheds within the county.

Monroe County, on average, receives forty-eight inches of rain per year. The U.S. average is thirty-seven inches of rain per year. Snowfall averages fifty-two inches in comparison to the average U.S. city receiving twenty-five inches of snow per year. The number of days with any measurable precipitation is 130 days of the year. On average, there are 192 sunny to moderately sunny days per year in Monroe County. The warmest month is July, where the high is around 82°F and the coldest month is January with an average low of 16°F.

The Koppen-Geiger Climate Areas map classifies Monroe County and the rest of Pennsylvania as Humid Continental (See *Figure 1 – Koppen-Geiger Climate Map*). While the counties of Pennsylvania share many weather similarities, there are also a few unique characteristics to the area.

Figure 1 - Koppen-Geiger Climate Map



Monroe County is a unique location among the counties in the Commonwealth of Pennsylvania. The natural beauty of the forested lands, mountains and creeks in the Poconos and the proximity to urban areas both within and outside of Monroe County, including Philadelphia and New York, contribute to making Monroe County a tourist destination. Areas such as Camelback Mountain Resort and the Pocono Raceway draw a large number of seasonal visitors, and the Mount Airy Resort and Casino draws visitors daily to the county from the tristate areas. According to a 2019 report published by the Pocono Mountain Visitors Bureau, 27.9 million tourists visited the Pocono region in 2018 contributing $3.3 billion in visitor spending and $370 million in state and local tax revenue.

2.2. Community Facts

Monroe County was formed in 1836 from parts of Northampton and Pike Counties and was named for President James Monroe. Stroudsburg was chosen as the county seat a year later, in

1837, and has remained the county seat since that time. Monroe County consists of a total of twenty municipalities: four boroughs and sixteen townships.

Monroe County has historically been a tourist-based economy; the Pocono Mountain Visitors Bureau estimates that the county sees nearly seventeen million tourists per year, nearly a third of which stay two or more nights in the county (Pocono Mountain Visitors Bureau, 2011). Tourists have visited Monroe County year-round to enjoy the amenities offered by the mountains, forests, and rivers. Both the lumber and agricultural industries in Monroe County also rely on the natural resources of the county. Currently, the top industries in Monroe County are tourism and healthcare. The healthcare industry in Monroe County has grown considerably with the new construction of St. Luke's University Health Network located in Stroud Township. St. Luke's University Health Network – Monroe Campus is the first new acute-care, non-replacement hospital Monroe County has seen in 100 years. Monroe County is easily accessed from both Philadelphia and New York City, making it a desirable location for commuters or families who want a second home.

Tourist areas include state and national parks as well as the other natural areas including Bushkill Falls, Delaware Water Gap National Recreation Area and the five lakes. Additionally, the resort areas in the county offer not only access to the natural beauty of the area, but also recreational activities including golf courses, tennis courts, swimming pools, and hiking trails. In the winter there are multiple ski resorts to attract tourists as well.

There are two institutions of higher education in Monroe County, East Stroudsburg University and the Monroe Campus of Northampton Community College. East Stroudsburg University was founded as East Stroudsburg Normal School in 1893 with a faculty of fifteen and a student enrollment of 320. The school became part of the Pennsylvania State System of Higher Education in 1920. The school began as a teacher's school but added liberal arts and science curricula in 1960.

Monroe County is home to the Tobyhanna Army Depot. They are a military technology center and the largest employer in Monroe County.

The following boroughs and townships are located in Monroe County:

Boroughs (4):

- Delaware Water Gap
- East Stroudsburg
- Mount Pocono
- Stroudsburg (county seat)

Townships (16):

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stroud Township
- Tobyhanna Township
- Tunkhannock Township

As of May 2021, Monroe County has 78,800 people in the civilian labor force, with 72,900 employed. There was an unemployment rate of 6.4% at the time of the previous plan. The COVID-19 pandemic increased the unemployment rate in Monroe County, the Commonwealth of Pennsylvania, and the United States of America. The peak unemployment rate for Monroe County came during the COVID-19 pandemic when 20.5% of the population of the county was unemployed during the spring months of 2020. This can be attributed to the temporary closing of businesses, including bars and restaurants, and cutbacks at companies. The most impacted industries during the downturn of the economy during the COVID-19 pandemic were the service industries, i.e. retail, food service, tourism, and entertainment. The most recent data provided from the state shows the unemployment percentage for Monroe County at 8.6% for the month of January 2021. The minimum unemployment percentage in the last ten years was 5% in Monroe County. The tourist industry that is the major source of income for the county was significantly impacted by travel restrictions and social distancing regulations brought about by the pandemic. These measures have proven essential to stop the spread of COVID-19 but have also severely hurt the industry and businesses that rely upon tourists. *Table 1 – Top Employers* illustrates the top fifty employers of the workforce of Monroe County based on 2020 data.

Table 1 - Top Employers

Monroe County Top 50 Employers (2020)			
Rank	**Name of Employer**	**Rank**	**Name of Employer**
1	Federal Government	26	Skytop Lodge
2	Sanofi Pasteur	27	Saint Luke's Physician Group Inc
3	Wal-Mart Associates Inc.	28	United Envelope LLC
4	Lehigh Valley Health Network	29	Weiler Corporation
5	Pocono Mountain School District	30	Fitzmaurice Community Services Inc
6	East Stroudsburg Are School District	31	Hayward Laboratories Inc
7	Mount Airy Casino Resort	32	URS Federal Services Inc
8	Kalahari Resorts & Conventions	33	Packard Pacifica Inc
9	Stroudsburg Area School District	34	Shawnee Inn
10	Saint Luke's Hospital	35	Staffing Synergies Inc
11	Pleasant Valley School District	36	Village Super Market of PA Inc
12	PA State System of Higher Education	37	Lake Naomi Club
13	Monroe County	38	Colonial Intermediate Unit No. 20
14	KSL Resorts	39	Aveanna Healthcare LLC
15	Weis Markets Inc	40	Home Depot USA Inc
16	State Government	41	Manpower US Inc
17	Great Wolf Resorts	42	United Parcel Service Inc
18	Kinsley's ShopRite	43	Providence Community Services Inc
19	FedEx Supply Chain Inc	44	Bayada Home Health Care Inc
20	Family Care Centers Inc	45	Target Corporation
21	FedEx Freight Inc	46	Pleasant Valley Manor Inc
22	Giant Food Stores LLC	47	East Stroudsburg Savings Association
23	Columbia Associates Management	48	Wawa Inc
24	Lowe's Home Centers LLC	49	Brookdale Drug and Alcohol Rehabilitation
25	National Distribution Centers LLC	50	Express Services Inc

2.3. Population and Demographics

Monroe County is the twentieth ranked county in terms of population within the Commonwealth of Pennsylvania. Monroe County has a recorded population of 169,842 from the 2010 United States Census with an estimated population of 170,271 for 2019. There are no official population statistics for the year of 2020 as the United States Census was delayed due to the worsening of the COVID-19 pandemic in the United States. The percent change from the 2010 official census records to the 2019 estimation provided by the United States Census Bureau is 0.3% over nine years. The populations per municipality are identified in *Table 2 – Municipal Population* below. The population density of the county is 279 people per square mile. *Figure 4 – Monroe County*

Population Density illustrates in a visual way the values of population density by census tracks from the U.S. 2010 Census.

In Monroe County, for the 2019 estimation of the population, 19.4% of the population is under the age of eighteen years old, 62.8% of the population is between the ages of nineteen and sixty-four, and 17.8% of the population is above the age of sixty-five. In Monroe County, various ethnic groups and races are present throughout. In accordance with the 2010 census, 131,162 residents were white, 22,348 residents were black/African American, and 16,332 residents were another race.

There were an estimated 58,875 households in the county in 2013. That estimate has increased since 2013 to 81,829 households in 2019. Of these households, 77.0% are owner-occupied and the median value of the owner-occupied homes in Monroe County is $168,000. The average household size based on 2019 estimations is 2.90 persons. Monroe County has a median household income of $69,934 based on 2019 estimates and the percentage of the people within the county who are below the poverty line is 12.2%.

Table 2 - Municipal Population

Monroe County Municipality Population			
Municipality	**Population**	**Municipality**	**Population**
Barrett Township	4,225	Paradise Township	3,186
Chestnuthill Township	17,156	Pocono Township	11,065
Coolbaugh Township	20,564	Polk Township	7,874
Delaware Water Gap Borough	746	Price Township	3,573
East Stroudsburg Borough	9,840	Ross Township	5,940
Eldred Township	2,910	Smithfield Township	7,357
Hamilton Township	9,083	Stroud Township	19,213
Jackson Township	7,033	Stroudsburg Borough	5,567
Middle Smithfield Township	15,997	Tobyhanna Township	8,554
Mount Pocono Borough	3,170	Tunkhannock Township	6,789
Source: 2010 Census Bureau			

There are five major transportation routes within the county that would be capable of handling a large amount of heavy truck traffic. The county is bisected by Interstate 80 and Interstate 380, with Interstate 80 running east to west and Interstate 380 running north from an interchange with Interstate 80. United States Route 209 traverses the bottom half of the county running from Carbon County to Pike County. There are two major state highways, State Route 33 and State

Route 611. State Route 33 is a four-lane expressway that connects Interstate 80 to Interstate 78 in Northampton County. State Route 611 traverses the county from south to north ending just short of the county line in Tobyhanna. There are other state roads capable of large amounts of traffic, including but not limited to: State Routes 115, 191, 314, 390, 402, 423, 447, 534 and 715. Major state routes can be viewed on the county base map, *Figure 2 – Monroe County Base Map*.

Lehigh Valley Hospital (LVH) – Pocono in East Stroudsburg and St. Luke's in Stroudsburg are the only hospitals located within the county. Prior to 2015, the Lehigh Valley Hospital (LVH) – Pocono in East Stroudsburg was the only hospital within the county. The groundbreaking for St. Luke's University Health Network occurred in April of 2015 and construction was completed in 2017. St Luke's then opened for public service. Lehigh Valley Hospital (LVH) – Pocono and St. Luke's University Health Network also operate walk-in clinics for urgent care in the county.

There are nineteen volunteer fire companies and five paid ambulance companies serving the county. There are three municipal and two regional police departments as wells as five school districts (4 public and one parochial). The Pennsylvania State Police also covers portions of the county that are not covered by a local or regional department.

2.4. Land Use and Development

The topography of Monroe County is mountainous which lends to the county having some of the best ski areas, parks, hiking trails and other natural resources in the region. At 2,214 feet, the highest point in the county is Kistler Ledge in Tobyhanna State Park. It is located in Coolbaugh Township near the Pike and Wayne County borders. The Park has activities open to the public year-round including hunting, fishing, camping, swimming, biking, and snowmobiling.

Monroe County has primarily forested and undeveloped land. In 2005, 6.8% of Monroe County was considered developed, which increased by almost 3% since 1992. Of the 93.2% of the county that is undeveloped, almost 86% of that land is forestland or limited agricultural land (DCED, 2005). While the percentage of the county remaining undeveloped may have changed from 2005-2016, it is important to note that the Monroe 2030 Comprehensive Plan aimed to retain a largely undeveloped character of the county and the county planning commission continues to work towards this goal with the 2030 Comprehensive Plan. *Figure 5 – Monroe County Land Cover* illustrates the different land uses and symbology for those values. A large portion, as outlined in the map, is forested and/or crops.

In the Monroe County 2030 Comprehensive Plan, the county planners and stakeholders identified the preservation of Monroe County's natural environment as a key challenge for the future. The threat to the natural environment and a threat to the fiscal environment came from sprawling sub-development growth patterns throughout the last decade of the 20th century. Monroe County identified four strategies to impact these trends, including an Open Space

Preservation program (MCPC, 1999). This program included $25 million in bonds to preserve open space.

The stress on development in Monroe County is a result of its rapid population growth, 350% since 1960, and, as discussed above, over 20% in the last decade. Most of this growth is a result of migration into the county from New York City and the surrounding tristate area including portions of New York and New Jersey. In addition to the Open Space Preservation program, Monroe County is encouraging municipalities to adopt resource protection ordinances in order to protect their natural resources while adapting to the population growth.

The most recent data that is available from the United States Department of Agriculture shows that there were 233 farms in Monroe County in 2017. This data is based off of a census conducted by the USDA every five years for agriculture in the United States and the Commonwealth of Pennsylvania. This is a decrease of 18% from the previous census conducted in 2012. The total number of farms in 2012 was 283. This is a 19% decrease from 2007 when there were 349 farms. In 2012 the total acres of farmland was 26,483, down from 29,165 in 2007. The total acreage of the farms from the 2017 data is 27,607 acres which is an increase in 4% from the previous census. The average size of a Monroe County farm is 94 acres, up from 84 acres in 2007. The average size of a Monroe County farm increased again from 2012 to 2017 by a percent change of 27%. The average market value of products sold per farm in Monroe County is $42,629. The Monroe County Agricultural Land Preservation Program is intended to protect and promote continued productive agricultural use on viable agricultural lands through the acquisition of agricultural conservation easements. Since its inception in 1990, the Agricultural Land Preservation Board has preserved over 119 farms and approximately 8,000 acres of agricultural land in Monroe County.

2.5. Data Sources

The county relied heavily on existing data sources developed by Monroe County and a variety of departments including but not limited to:

- Monroe County Hazard Vulnerability Analysis.
- Monroe County 2030 Comprehensive Plan.
- Monroe County Assessment Department Data.
- Monroe County Open Space, Greenway, and Recreation Plan.
- Monroe County Digital Tax Assessment Data.
- Monroe County Knowledge Center.
- Monroe County Commodity Flow Studies.

The following are additional data sources used during the update process:

- United States Census Bureau.
- National Climatic Data Center (NCDC).
- National Oceanic and Atmospheric Administration (NOAA).
- Pennsylvania Department of Conservation and Natural Resources (DCNR).
- Pennsylvania Groundwater Information System.
- Pennsylvania Emergency Incident Reporting System.
- Pennsylvania Emergency Management Agency.

The countywide Digital Flood Insurance Rate Maps (DFIRM), were used for all flood risk analysis and estimation of loss. The Monroe DFIRMs were approved and effective in 2013. The DFRIM database provides flood frequency and elevation information used in the flood hazard risk assessment. Other Monroe County GIS datasets including road centerlines, structures, and municipalities were utilized in conjunction with the DFIRM data.

Geographic Information Systems (GIS) Data

GIS data was utilized in risk assessment, estimation of loss and the development of map products for the hazard mitigation plan update. A core foundation of data was available from the Monroe County Planning Commission. Some data was downloaded from the Pennsylvania Spatial Data Access (PASDA) and utilized. A large portion of the plan utilizes census data from the United States Census Bureau, but the 2020 census was interrupted by the COVID-19 pandemic in 2020 – 2021. The 2020 census was delayed, and the information received during the census was spread out due to social distancing and the limiting of field workers and census takers going door to door to gather information.

The following is a list of existing GIS data that was utilized in the plan update process and a list of new GIS data that was developed to complete the 2021 mitigation plan update.

Existing Monroe County GIS Data Used:

- Structures
- Road Centerlines
- Municipality Boundaries
- Streams
- Lakes
- Fire stations, police stations, EMS stations
- Utility locations

New GIS Date Developed and Used:

- Critical Infrastructure / Functional Needs Facilities

- Mobile Homes
- Tornado Paths

The Monroe County parcel dataset includes a value for the land in each parcel, as well as a combined value for all buildings on each parcel. Some parcels that contain multiple buildings with one or more buildings in the flood plain and one or more buildings out of the flood plain. The individual value by specific building within any given parcel was indeterminate from the data provided by Monroe County. Therefore, the combined value of all buildings in that parcel has been used – not simply the value of only the structures in the floodplain.

HAZUS calculations and statistics were based on a total of twelve reaches. There were zero failed reaches. The loss estimations were completed as part of the HAZUS scenario processing and represent FEMA depths grids and general building information from FEMA's general building stock.

The following maps provide a base map of Monroe County and other specific features of the county.

Figure 2 - Monroe County Base Map

Figure 3 - Monroe County Small Watersheds

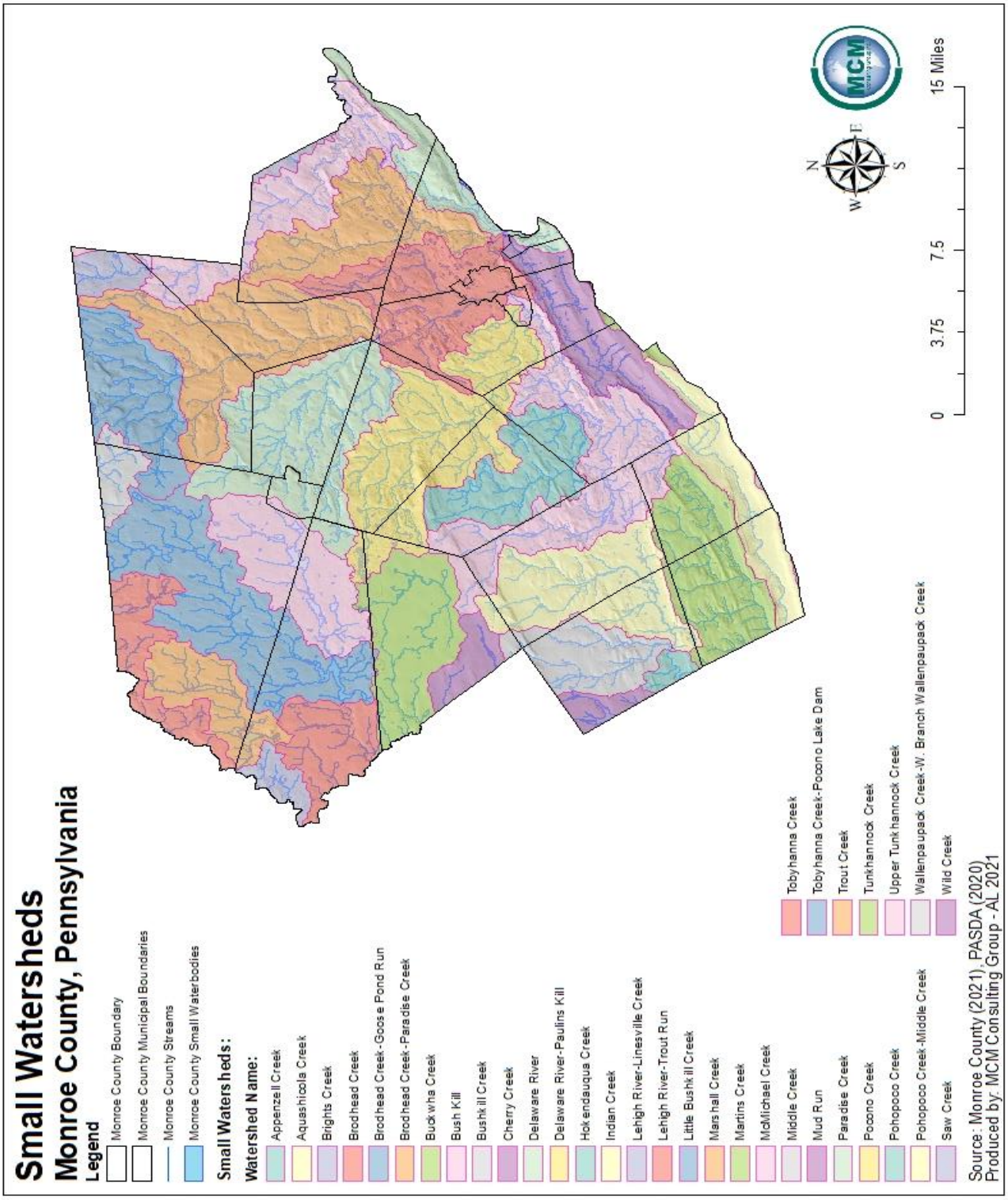


Figure 4 - Monroe County Population Density

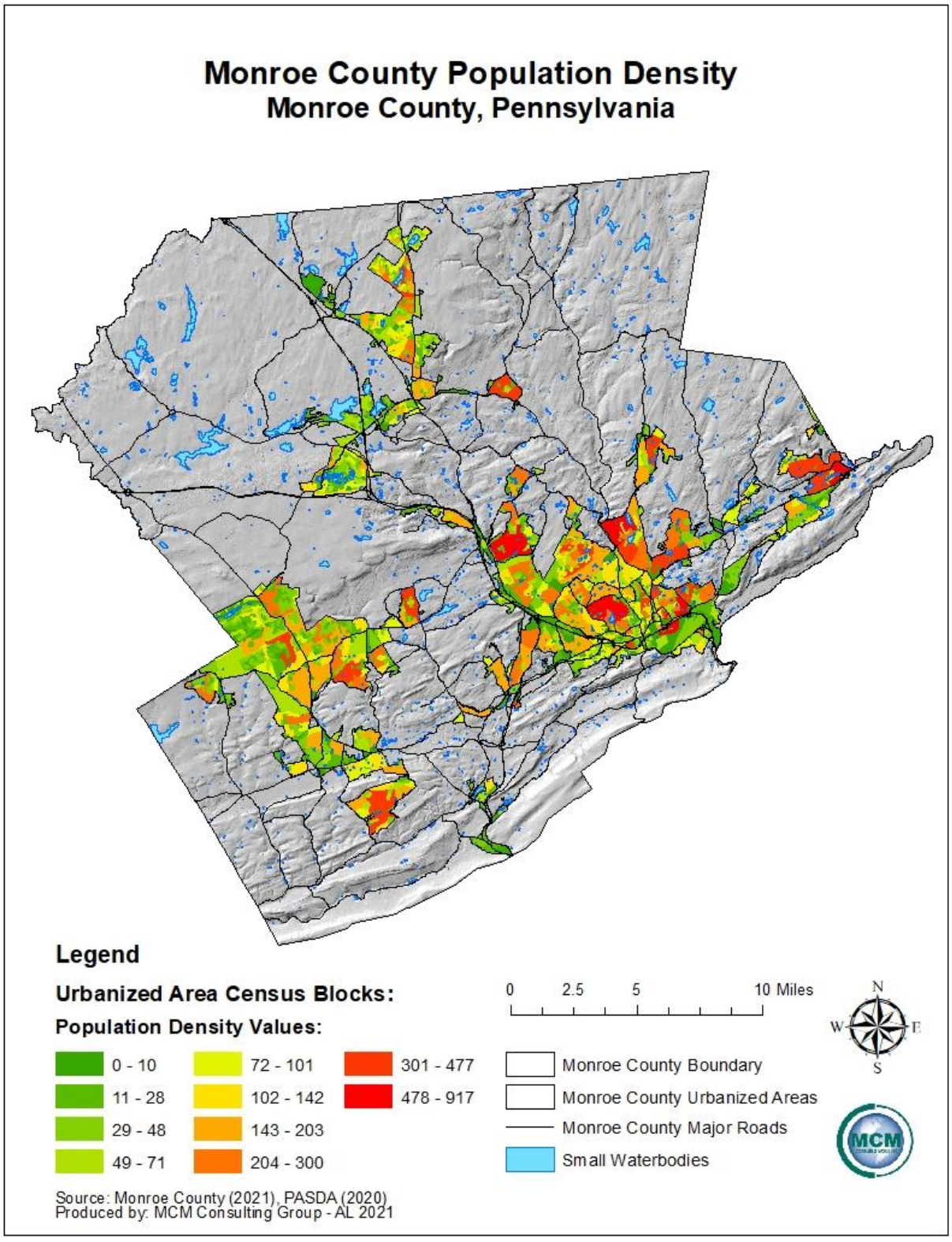
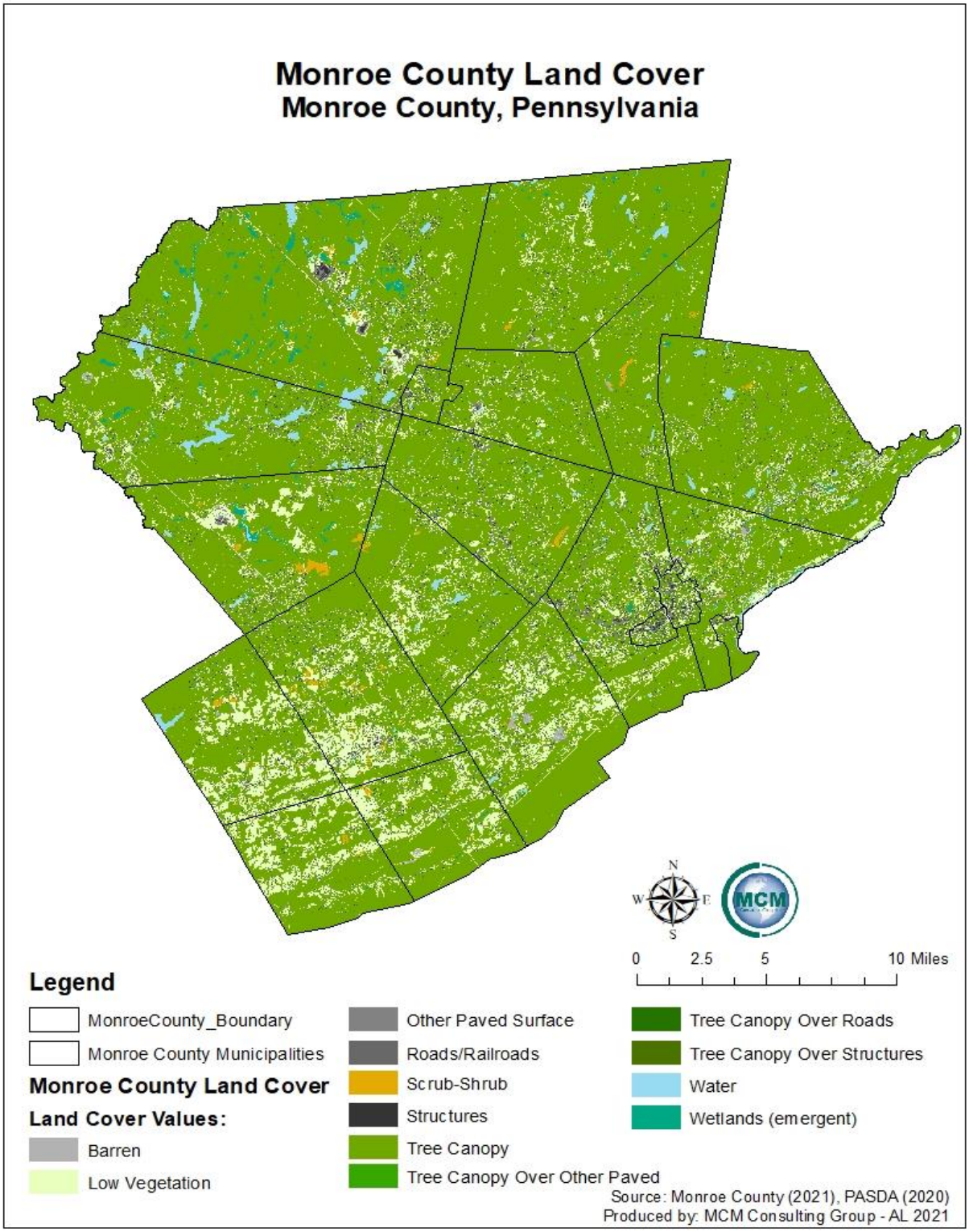


Figure 5 - Monroe County Land Cover



3. Planning Process

3.1. Update Process and Participation Summary

The Monroe County Hazard Mitigation Plan update began January 8, 2021. The Monroe County Commissioners were able to secure a hazard mitigation grant to start the process. The Monroe County Office of Emergency Management was identified as the lead agency for the Monroe County Hazard Mitigation Plan update. The planning process involved a variety of key decision makers and stakeholders within Monroe County. Monroe County immediately determined that the utilization of a contracted consulting agency would be necessary to assist with the plan update process. MCM Consulting Group, Inc. was selected as the contracted consulting agency to complete the update of the hazard mitigation plan. The core hazard mitigation team, which was referred to as the steering committee, included officials from the Monroe County Office of Emergency Management, Monroe County Planning Commission, and MCM Consulting Group, Inc. (MCM).

The process was developed around the requirements laid out in the Federal Emergency Management Agency (FEMA) Local Hazard Mitigation Plan Review Tool, referenced throughout this plan, as well as numerous other guidance documents including, but not limited to, Pennsylvania's All-Hazard Mitigation Standard Operating Guide, FEMA's State and Local Mitigation Planning How-to Guide series of documents (FEMA 386-series) and the National Fire Protection Association (NFPA) 1600 Standard on Disaster/Emergency Management and Business Continuity Programs.

MCM Consulting Group, Inc. assisted Monroe County Planning Commission, as well as Monroe County Office of Emergency Management in coordinating and leading public involvement meetings, local planning team meetings, analysis, and the writing of the updated HMP. The Monroe County Local Planning Team (LPT) worked closely with MCM in the writing and review of the HMP. MCM conducted project meetings and local planning team meetings throughout the process. Due to COVID-19, most meetings were held virtually. Meeting agendas, meeting minutes, and sign-in sheets were developed and maintained for each meeting conducted by MCM. These documents are detailed in Appendix C of this plan.

Public meetings with local elected officials were held, as well as work sessions and in-progress review meetings with the Monroe County Local Planning Team and staff. Due to COVID-19, most of the meetings were held virtually. At each of the public meetings, respecting the importance of local knowledge, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capability assessment and review, and eventually adopt the county hazard mitigation plan. Monroe County

will continue to work with all local municipalities to collect local hazard mitigation project opportunities.

The HMP planning process consisted of:

- Applying for and receiving a hazard mitigation planning grant (HMPG) to fund the planning project.
- Announcing the initiative via press releases and postings on the county website.
- Involving elected and appointed county and municipal officials in a series of meetings, training sessions, and workshops.
- Encouraging all residents of Monroe County to complete surveys.
- Identifying capabilities and reviewed the information with the municipalities.
- Identifying hazards.
- Assessment of risk and analyzing vulnerabilities.
- Identifying mitigation strategies, goals, and objectives.
- Developing an implementation plan.
- Announcing completion via press release and postings on the county website.
- Plan adoption at a public meeting of the Monroe County Board of Commissioners.
- Plan submission to FEMA and PEMA.

The 2021 Monroe County HMP was completed September 5, 2021 and submitted to the Pennsylvania Emergency Management Agency for review and approval. The 2021 plan follows an outline developed by PEMA which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. The 2021 HMP format is consistent with the PEMA recommended format. The 2021 Monroe County HMP has additional hazard profiles that were added to the HMP and which increased the subsections in section 4.3 of this plan update.

3.2. The Planning Team

In order to represent the county, the Monroe County Steering Committee developed a diversified list of potential local planning team (LPT) members. Members who participated in the 2016 hazard mitigation plan were highly encouraged to join the 2021 team. The steering committee then provided invitations to the prospective members and provided a description of duties to serve on the LPT. The following agencies, departments and organizations were invited to participate in the LPT: Monroe County Commissioners, Monroe County Conservation District, Monroe County Planning Commission, East Stroudsburg University, Pleasant Valley School District, Pocono Mountain School District, Monroe County Technical Institute, and all twenty municipalities. The invitations for membership of the LPT were disseminated by the Monroe County Office of Emergency Management utilizing letters, email, and telephone calls. The LPT

worked throughout the process to plan and hold meetings, collect information, and conduct public outreach.

The stakeholders listed in *Table 3 – Local Planning Team* served on the 2021 Monroe County Hazard Mitigation Local Planning Team, actively participated in the planning process by attending meetings, completing assessments, surveys, and worksheets and/or submitting comments.

Table 3 - Local Planning Team

Monroe County Hazard Mitigation Plan Update Local Planning Team		
Name	**Organization**	**Position**
Maryellen Keegan	Monroe County OEM	Director
Christine Meinhart-Fritz	Monroe County Planning Commission	Director
Lynda Messerschmidt	Monroe County OEM	Emergency Preparedness Planner
Kristina Heaney	Monroe Co. Conservation District	District Manager
Annie Polkowski	Monroe Co. Conservation District	Watershed Specialist
Kevin Dixon	Middle Smithfield Township	Elected or Appointed Official
Kevin Transue	Paradise Township	Elected or Appointed Official
Tina Transue	Paradise Township	Elected or Appointed Official
Larry Freshcorn	Delaware Water Gap	Elected or Appointed Official
Allison Trotter	Delaware Water Gap	Elected or Appointed Official
Nate Black	East Stroudsburg University	Director
Budy Buzzard	Hamilton Township	Elected or Appointed Official
Bob Heil	Hamilton Township	Elected or Appointed Official
Julia Heilakka	Smithfield Township	Elected or Appointed Official
Rich Gannon	Mount Pocono Borough	Elected or Appointed Official
Michael Penn	Mount Pocono Borough	Elected or Appointed Official
Patti O'Keefe	Barrett Township	Elected or Appointed Official
Rudy Haab	Barrett Township	Elected or Appointed Official
Dave Albright	Chestnuthill Township	Elected or Appointed Official
Lynn Courtright	Pleasant Valley School District	Elected or Appointed Official
Bill Byron	Tunkhannock Township	Elected or Appointed Official
Curtis Beam, Facility Ops Mgr.	Pocono Mountain School District	Maintenance Supervisor

Monroe County Hazard Mitigation Plan Update Local Planning Team		
Name	**Organization**	**Position**
Vicky Schuch	Pocono Mountain School District	Procurement Supervisor
Eric Hoffman	Chestnuthill Township	Elected or Appointed Official
Brian Stankovich	Ross Township	Elected or Appointed Official
Gary Hoffman	Eldred Township	Elected or Appointed Official
Daryl Eppley	Stroud Township	Elected or Appointed Official
Joshua Walker	Mount Pocono Borough	Elected or Appointed Official
Bill Weimer	Coolbaugh Township	Elected or Appointed Official
Erin Masker	Coolbaugh Township	Elected or Appointed Official
Ann Velopolcek	Eldred Township	Elected or Appointed Official
John Christy	Monroe County Commissioner	County Commissioner
John Brown	Monroe County Technical Institute	Principal
Marv Walton	East Stroudsburg Borough	Elected or Appointed Official
Brian Bond	East Stroudsburg Borough	Elected or Appointed Official
Becky Smith	East Stroudsburg Borough	Elected or Appointed Official
Renee Miller	Jackson Township	Elected or Appointed Official
Keith Elliott	Jackson Township	Elected or Appointed Official
Mike Wisniewski	Jackson Township	Elected or Appointed Official
Taylor Munoz	Pocono Township	Elected or Appointed Official
Jerrod Belvin	Pocono Township	Elected or Appointed Official
Barry Borger	Polk Township	Elected or Appointed Official
Mary Beth Serfass	Polk Township	Elected or Appointed Official
Cheryl Harmon/Bob Wilson	Price Township	Elected or Appointed Official
Mary Pat Quinn	Stroudsburg Borough	Elected or Appointed Official
Bob Bartal	Tobyhanna Township	Elected or Appointed Official
Betsy Tiene	Tobyhanna Township	Elected or Appointed Official
Lawrence Kopp	Stroudsburg Borough	Elected or Appointed Official
Dr. Lee Lesisko	Pleasant Valley School District	Elected or Appointed Official
Corbin Snyder	MCM Consulting Group, Inc.	Consultant
Valerie Zents	MCM Consulting Group, Inc.	Consultant
Michael Rearick	MCM Consulting Group, Inc.	Senior Consultant

3.3. Meetings and Documentation

Meetings with local elected officials and the local planning team were held as needed. Meetings were mostly held via conference call and virtual meeting rooms due to COVID-19. At each of the meetings, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capability assessment, review and eventually adopt the multi-jurisdictional HMP. *Table 4 – HMP Process Timeline* lists the meetings held during the HMP planning process, which organizations and municipalities attended and the topic that was discussed at each meeting. All meeting agendas, sign-in sheets, presentation slides, and other documentation are located in Appendix C.

The draft plan was made available for public review on July 2, 2021. The draft was advertised on Monroe County's social media page and was made available digitally on the Monroe County website at: http://www.monroecountypa.gov/hazmit

The public comment period remained open until August 6, 2021. All public comments were submitted via an online survey or to the Monroe County Office of Emergency Management at: mcoem@monroecountypa.gov. All public comments have been included in this plan in Appendix C.

Table 4 - HMP Process Timeline

Monroe County HMP Process - Timeline		
Date	**Meeting**	**Description**
01/08/2021	Monroe County Hazard Mitigation Plan (HMP) Kick-Off meeting	Identified challenges and opportunities as they relate to fulfilling the DMA 2000 requirements. Identified existing studies and information sources relevant to the hazard mitigation plan. Identified stakeholders, including the need to involve local officials. Presentation on hazard identification, capability assessment and NFIP worksheets.
02/04/2021	Local Planning Team (LPT) initial meeting	Defined hazard mitigation planning and identified roles and responsibilities. Discussed the 2016 hazard mitigation plan and defined a timeline to complete the update. Presentation on hazard identification, capability assessment and NFIP worksheets.
03/03/2021	Local Planning Team meeting – Selection of Hazards	Monroe County LPT met via Zoom to discuss hazards profiled in the previous plan and identify any *new* hazards to be included in the plan update.

Monroe County HMP Process - Timeline		
Date	**Meeting**	**Description**
03/31/2021	Local Planning Team Meeting – Risk Factor Assessment	Monroe County LPT met via Zoom to determine a risk factor score for each of the selected hazards in the 2021 update.
04/15/2021	Local Planning Team meeting – Mitigation Strategy	Monroe County LPT met via Zoom to start mitigation strategy development by reviewing goals and objectives from the 2016 plan. Additionally, the LPT discussed *new* goals and objectives for the 2021 plan update.
04/15/2021 & 04/16/2021 & 04/22/2021	Meetings with municipal officials	Virtual meetings. Educated county and local elected officials on the hazard mitigation planning process. Presented the findings of the hazard vulnerability analysis and risk assessment. Sought input for mitigation projects throughout the county. Distributed hazard mitigation project opportunity forms. Distributed review worksheets from the 2016 HMP.
04/26/2021	Steering Committee meeting – Mitigation Strategy	Monroe County Steering Committee met via Zoom to discuss 2021 goals, objectives, and actions for mitigation strategy development.
04/29/2021	Steering Committee meeting – Mitigation Strategy	Monroe County Steering Committee met via Zoom to discuss 2021 goals, objectives, and actions for mitigation strategy development.
05/04/2021	Risk Assessment Public Meeting	Due to COVID-19, a recorded presentation was created and posted on social media and on the county website. This presentation covered the risk assessment section of the Monroe County Hazard Mitigation Plan and was posted via social media and on the county website. Members of the public were encouraged to read and submit any comments on this section via email.
05/06/2021	Steering Committee meeting – Mitigation Strategy	Monroe County Steering Committee met via Zoom to discuss 2021 goals, objectives, and actions for mitigation strategy development.
05/11/2021	Steering Committee meeting – Mitigation Strategy	Monroe County Steering Committee met via Zoom to discuss 2021 goals, objectives, and actions for mitigation strategy development.

Monroe County HMP Process - Timeline		
Date	**Meeting**	**Description**
06/17/2021	Local Planning Team meeting – Draft Plan review	The draft HMP was made available to all members of the LPT prior to the start of the public review period. All were invited to submit any changes to the document before it was released to the public.
06/22/2021	Monroe County Hazard Mitigation Plan – Draft Plan public review	The draft HMP presentation was held in-person, via Zoom, and was made available on YouTube. All members of the public were invited to submit any comments via an online survey or provide comments to the Monroe Office of Emergency Management.

3.4. Public and Stakeholder Participation

Monroe County engaged numerous stakeholders and encouraged public participation during the HMP update process. Advertisements for public meetings were completed utilizing the local newspaper and the Monroe County website. Copies of those advertisements are located in Appendix C. Municipalities and other county entities were invited to participate in various meetings and encouraged to review the update various worksheets and surveys. Copies of all meeting agendas, meeting minutes and sign-in sheets are located in Appendix C. Worksheets and surveys completed by the municipalities and other stakeholders are located in appendices of this plan update as well. Municipalities were also encouraged to review hazard mitigation related items with other constituents located in the municipality like businesses, academia, private and nonprofit interests.

The tools listed below were distributed with meeting invitations, provided directly to municipalities for completion and return to the Monroe County Office of Emergency Management or at meetings to solicit information, data, and comments from both local municipalities and other key stakeholders. Responses to these worksheets and surveys are available for review at the Monroe County Office of Emergency Management.

1. **Risk Assessment Hazard Identification and Risk Evaluation Worksheet**: Capitalizes on local knowledge to evaluate the change in the frequency of occurrence, magnitude of impact and/or geographic extent of existing hazards and allows communities to evaluate hazards not previously profiled using the Pennsylvania Standard List of Hazards.
2. **Capability Assessment Survey**: Collects information on local planning, regulatory, administrative, technical, fiscal, and political capabilities that can be included in the countywide mitigation strategy.
3. **Municipal Project Opportunity Forms and Mitigation Actions**: Copies of the 2016 mitigation opportunity forms that were included in the current HMP were provided to the

municipalities for review and amendment. These opportunities are located in Appendix G. The previous mitigation actions were provided and reviewed at update meetings. New 2021 municipal project opportunity forms are included as well, located in Appendix G.

4. **National Flood Insurance Program Survey:** Collects data from county residents and measures their level of participation in the National Flood Insurance Program (NFIP) provided by FEMA.

As a result of COVID-19, the normal approach to engaging public input could not be taken. In an effort to capture public input, in lieu of a traditional approach to hazard mitigation, the Monroe County LPT decided to utilize a virtual survey platform where any member of the public could pose a question or comment regarding the entire HMP document. Additionally, all Monroe County residents were encouraged to complete a survey posing questions related to hazard mitigation and emergency management in Monroe County. Members of the public were also encouraged to contact Monroe County Office of Emergency Management or MCM Consulting Group, Inc. with any comments or questions regarding this update. Any public comment that was received during public meetings or during the draft review of the plan were documented and included in the plan. Copies of newspaper public meetings notices, website posted public notices, and other correspondence are included in Appendix C of this plan.

Monroe County invited all contiguous counties to review the 2021 draft hazard mitigation plan. A letter was sent to the emergency management coordinator in Carbon, Lackawanna, Luzerne, Northampton, Pike and Wayne counties in Pennsylvania, and Sussex and Warren Counties in New Jersey on June 4, 2021. Copies of these letters are included in Appendix C Multi-Jurisdictional Planning.

3.5. Multi-Jurisdictional Planning

Monroe County used an open, public process to prepare this HMP. Meetings and letters to municipal officials were conducted to inform and educate them about hazard mitigation planning and its local requirements. Municipal officials provided information related to existing codes and ordinances, the risk and impacts of known hazards on local infrastructure and critical facilities and recommendations for related mitigation opportunities. The pinnacle to the municipal involvement process was the adoption of the final plan. *Table 5 – Municipality Participation in Worksheets, Surveys, and Forms* reflects the municipality participation by completing worksheets, surveys, and forms.

Table 5 - Municipality Participation in Worksheets, Surveys, and Forms

Municipality Participation in Worksheets, Surveys and Forms			
Municipality	**Capability Assessment Survey**	**Risk Assessment Hazard Identification and Risk Evaluation Worksheet**	**Hazard Mitigation Opportunity Form Review and Updates**
Barrett Township	X	X	
Chestnuthill Township	X	X	
Coolbaugh Township	X	X	X
Delaware Water Gap Borough	X	X	
East Stroudsburg Borough	X	X	X
Eldred Township	X	X	X
Hamilton Township	X	X	X
Jackson Township	X	X	X
Middle Smithfield Township	X	X	X
Mount Pocono Borough	X	X	X
Paradise Township	X	X	X
Pocono Township	X	X	X
Polk Township	X	X	
Price Township	X	X	
Ross Township	X	X	
Smithfield Township	X	X	X
Stroud Township	X	X	X
Stroudsburg Borough	X	X	
Tobyhanna Township	X	X	
Tunkhanock Township	X	X	X

In March of 2020, Pennsylvania and the rest of the world experienced a pandemic event entitled COVID-19. Unfortunately, because of the pandemic, public meetings were unable to be held as normal during the hazard mitigation planning process. In lieu of a public meeting for the risk factor assessment results of the plan update were posted to Monroe County's website as well as their social media platforms. Members of the public were encouraged to submit any comments via SurveyMonkey, an online survey platform, or to contact MCM Consulting Group, Inc. with any questions or comments.

All twenty municipalities within Monroe County adopted the 2016 Monroe County Hazard Mitigation Plan as the municipal hazard mitigation plan. The goal of the Monroe County Local

Planning Team is to have 100% participation by municipalities in adopting the 2021 Monroe County Hazard Mitigation Plan.

4. Risk Assessment

4.1. Update Process Summary

A key component to reducing future loss is to first have a clear understanding of what the current risks are and what steps may be taken to lessen their threat. The development of the risk assessment is a critical first step in the entire mitigation process, as it is an organized and coordinated way of assessing potential hazards and risks. The risk assessment identifies the effects of both natural and human-caused hazards and describes each hazard in terms of its frequency, severity, and county impact. Numerous hazards were identified as part of the process.

A risk assessment evaluates threats associated with a specific hazard and is defined by probability and frequency of occurrence, magnitude, severity, exposure, and consequences. The Monroe County risk assessment provides in-depth knowledge of the hazards and vulnerabilities that affect Monroe County and its municipalities. This document uses an all-hazards approach when evaluating the hazards that affect the county and the associated risks and impacts each hazard presents.

This risk assessment provides the basic information necessary to develop effective hazard mitigation/prevention strategies. Moreover, this document provides the foundation for the Monroe County Emergency Operations Plan (EOP), local EOPs and other public and private emergency management plans.

The Monroe County risk assessment is not a static document, but rather, is a biennial review requiring periodic updates. Potential future hazards include changing technology, new facilities and infrastructure, dynamic development patterns and demographic and socioeconomic changes into or out of hazard areas. By contrast, old hazards, such as brownfields and landfills, may pose new threats as county conditions evolve.

Using the best information available and geographic information systems (GIS) technologies, the county can objectively analyze its hazards and vulnerabilities. Assessing past events is limited by the number of occurrences, scope and changing circumstances. For example, ever-changing development patterns in Pennsylvania have a dynamic impact on traffic patterns, population density and distribution, stormwater runoff and other related factors. Therefore, limiting the risk assessment to past events is myopic and inadequate.

The Monroe County Local Planning Team reviewed and assessed the change in risk for all natural and human-caused hazards identified in the 2016 hazard mitigation plan. The mitigation planning team then identified hazards that were outlined within the Pennsylvania Hazard Mitigation Plan but not included in the 2016 Monroe County Hazard Mitigation Plan that could

impact Monroe County. The team utilized the hazard identification and risk evaluation worksheet that was provided by the Pennsylvania Emergency Management Agency.

The Monroe County Steering Committee met with municipalities and provided guidance on how to complete the municipal hazard identification and risk evaluation worksheet. All twenty municipalities in Monroe County and East Stroudsburg University returned a completed worksheet. This information was combined with the county information to develop an overall list of hazards that would need to be profiled.

Once the natural and human-caused hazards were identified and profiled, the local planning team then completed a vulnerability assessment for each hazard. An inventory of vulnerable assets was completed utilizing GIS data and local planning team knowledge. The team used the most recent Monroe County assessment data to estimate loss to particular hazards. Risk factor was then assessed to each of the twenty-two hazards utilizing the hazard prioritization matrix. This assessment allows the county and its municipalities to focus on and prioritize local mitigation efforts on areas that are most likely to be damaged or require early response to a hazard event.

4.2. Hazard Identification

4.2.1. Presidential and Gubernatorial Disaster Declarations

Table 6 – Presidential and Gubernatorial Disaster Declarations and Proclamations contains a list of all Presidential and Gubernatorial disaster declarations that have affected Monroe County and the municipalities from 1955 through 2021, according to the Pennsylvania Emergency Management Agency.

Table 6 - Presidential and Gubernatorial Disaster Declarations and Proclamations

Presidential and Gubernatorial Disaster Declarations and Proclamations		
Date	**Hazard Event**	**Action**
September, 1955	Drought	Gubernatorial Declaration
January, 1966	Heavy snow	Gubernatorial Declaration
February, 1972	Heavy snow	Gubernatorial Declaration
June, 1972	Flood (Agnes)	Presidential Disaster Declaration
February, 1974	Truckers' strike	Gubernatorial Declaration
September, 1975	Severe storms, heavy rains, flooding	Presidential Disaster Declaration
January, 1978	Heavy snow	Gubernatorial Declaration
February, 1978	Blizzard	Gubernatorial Declaration
March, 1993	Blizzard	Presidential Emergency Declaration
January, 1994	Severe winter storms	Presidential Disaster Declaration

Date	Hazard Event	Action
September, 1995	Drought	Gubernatorial Declaration
January, 1996	Severe winter storms	Presidential Disaster Declaration
January, 1996	Flooding	Presidential Disaster Declaration
July, 1999	Drought	Gubernatorial Declaration
September, 1999	Hurricane Floyd	Presidential Disaster Declaration
December, 1999	Drought	Gubernatorial Declaration
September, 2003	Hurricane Isabel/Henri	Presidential Disaster Declaration
September, 2004	Tropical Depression Ivan	Presidential Disaster Declaration
September, 2005	Hurricane Katrina	Gubernatorial Proclamation of Emergency
September, 2006	Tropical depression Ernesto	Gubernatorial Proclamation of Emergency
February, 2007	Severe winter storm	Gubernatorial Proclamation of Emergency
February, 2007	Waive the regulations regarding hours-of-service limitations for drivers of commercial vehicles	Gubernatorial Proclamation of Emergency
April, 2007	Severe storm	Gubernatorial Declaration
April, 2007	Severe winter storm	Gubernatorial Proclamation of Emergency
February, 2010	Severe winter storm	Gubernatorial Proclamation of Emergency
October, 2010	Hurricane Sandy	Presidential Emergency Declaration
January, 2011	Severe winter storm	Gubernatorial Proclamation of Emergency
September, 2011	Severe storms and flooding (Lee/Irene)	Gubernatorial Proclamation of Emergency
April, 2012	Spring, winter storms	Gubernatorial Proclamation of Emergency
October, 2012	Hurricane Sandy	Gubernatorial Proclamation of Emergency
June, 2013	High winds, thunderstorms, heavy rain, tornado, flooding	Gubernatorial Proclamation of Emergency

Date	Hazard Event	Action
January, 2014	Extended prolonged cold	Gubernatorial Proclamation of Emergency
January, 2014	Driver hours waived due to prolonged and continued severe winter weather	Gubernatorial Proclamation of Emergency
February, 2014	Severe winter weather	Gubernatorial Proclamation of Emergency
February, 2014	Severe winter storm	Presidential Proclamation of Emergency
March, 2017	Severe winter storm	County and Municipal Declarations
July, 2017	Flash flooding	County and Municipal Declarations
January, 2018	Opioid crisis	Gubernatorial Proclamation of Emergency
March, 2020	COVID-19	Presidential Disaster Declaration
August, 2020	Tropical Storm Isaias	County and Municipal Declarations
February, 2021	Severe winter storm	County and Municipal Declarations
Source: Pennsylvania Emergency Management Agency and Federal Emergency Management Agency		

4.2.2. Summary of Hazards

The Monroe County Local Planning Team (LPT) was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2021 HMP Update. Following a review of the hazards considered in the 2016 HMP and the standard list of hazards, the local planning team decided that the 2021 plan should identify, profile, and analyze twenty-two hazards. These twenty-two hazards include all of the hazards profiled in the 2016 plan. The list below contains the twenty-two hazards that have the potential to impact Monroe County as identified through previous risk assessments, the Monroe County Hazard Vulnerability Analysis and input from those who participated in the 2021 HMP update. Hazard profiles are included in Section 4.3. for each of these hazards.

Identified Natural Hazards

Drought

Drought is defined as a deficiency of precipitation experienced over an extended period of time, usually a season or more. Droughts increase the risk of other hazards, like wildfires, flash floods, and landslides or debris flows. This hazard is of particular concern in Pennsylvania due to the prevalence of farming and other water-dependent industries, water dependent recreation uses, and residents who depend on wells for drinking water.

Earthquake

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10 to 20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of people and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake. (FEMA, 1997).

Extreme Temperature

Extreme heat often results in the highest number of annual deaths of all weather-related hazards. In most of the United States, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. Extremely cold air comes every winter in at least part of the country and affects millions of people across the United States. The arctic air, together with brisk winds, can lead to dangerously cold wind chill values. People exposed to extreme cold are susceptible to frostbite and hypothermia in a matter of minutes.

Flooding, Flash Flooding and Ice Jam Flooding

Flooding is the temporary condition of partial or complete inundation of normally dry land, and it is the most frequent and costly of all-natural hazards in Pennsylvania. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams.

Hurricane/Tropical Storm/Nor'easter

Hurricanes, tropical storms, and nor'easters are classified as cyclones and are any closed circulation developing around a low-pressure center in which the winds rotate counterclockwise (in the Northern Hemisphere) and whose diameter averages 300 miles across with the average eye being 20-40 miles across. Potential threats from hurricanes include powerful winds, heavy rainfall, storm surges, coastal and inland flooding, rip currents, tornadoes, and landslides. The Atlantic hurricane season runs from June 1 to November 30.

Invasive Species

An invasive species is a species that is not indigenous to the ecosystem under consideration and whose introduction causes or is likely to cause economic, environmental, or human harm. These species can be any type of organism: plant, fish, invertebrate, mammal, bird, disease, or pathogen.

Pandemic and Infectious Diseases

A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner, and causing serious illness. An epidemic describes a smaller scale infectious outbreak, within a region or population, that emerges at a disproportionate rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time.

Tornadoes, Windstorm

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. About 1,250 tornadoes occur in the U.S. each year, with about sixteen occurring in Pennsylvania. Damaging winds exceeding 50-60 miles per hour can occur during tornadoes, severe thunderstorms, winter storms, or coastal storms. These winds can have severe impacts on buildings, pulling off the roof covering, roof deck, or wall siding and pushing or pulling off the windows.

Wildfire

A wildfire is an unplanned fire that burns in a natural area. Wildfires can cause injuries or death and can ruin homes in their path. Wildfires can be caused by humans or lightning, and can happen anytime, though the risk increases in periods of little rain. In Pennsylvania, 98% of wildfires are caused by people.

Winter Storm

A winter storm is a storm in which the main types of precipitation are snow, sleet, or freezing rain. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Most deaths from winter storms are not directly related to the storm itself, but result from traffic accidents on icy roads, medical emergencies while shoveling snow, or hypothermia from prolonged exposure to cold.

Identified Human-Caused Hazards

Dam Failure

Dam failure is the uncontrolled release of water (and any associated wastes) from a dam. This hazard often results from a combination of natural and human causes, and can follow other hazards such as hurricanes, earthquakes, and landslides. The consequences of dam failures can include property and environmental damage and loss of life.

Disorientation

Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. Search and rescue efforts are focused in and around state forest and state park lands.

Drowning

Drowning is death from suffocation, typically associated with swimming, fishing, boating or bridge accidents, or suicide. It can be a significant hazard in communities with numerous residential pools or water bodies (e.g. ponds, lakes, rivers, etc.) and extensive outdoor recreational activity. Drowning rates are particularly high for children ages 1-14. The Centers for Disease Control and Prevention estimates that drowning is the second leading cause of injury death (after motor vehicle crashes) among children ages 1-14.

Emergency Services Shortage

Emergency medical services (EMS), police, and fire department services play a crucial role in the emergency response system, and the functionality of these emergency services directly impacts many of the other hazard profiles in this report. EMS, fire services, and police face challenges from lack of funding and lower rates of volunteerism.

Environmental Hazards/Hazardous Materials

Environmental hazards are hazards that pose threats to the natural environment, the built environment and public safety through the diffusion of harmful substances, materials, or products. Environmental hazards include the following:

- Hazardous material releases: at fixed facilities or as such materials are in transit and including toxic chemicals, infectious substances, biohazardous waste and any materials that are explosive, corrosive, flammable, or radioactive (PL 1990-165, § 207(e)).

- Air or Water Pollution; the release of harmful chemical and waste materials into water bodies or the atmosphere, for example (National Institute of Health Sciences, July 2009; Environmental Protection Agency, Natural Disaster PSAs, 2009).
- Superfund Facilities: hazards originating from abandoned hazardous waste sites listed on the National Priorities List (Environmental Protection Agency, National Priorities List, 2009).
- Manure Spills: involving the release of stored or transported agricultural waste, for example (Environmental Protection Agency, Environmental Impacts of…, 1998).
- Product Defect or Contamination; highly flammable or otherwise unsafe consumer products and dangerous foods (Consumer Product Safety Commission, 2003).

Hazardous material releases can contaminate air, water, and soils and have the potential to cause injury or death. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events.

Levee Failure

A levee is a human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide protection from temporary flooding (FEMA, 2016). A levee failure or breach occurs when a levee fails to prevent flooding on the landside of the levee. The consequences of a sudden levee failure can be catastrophic, with the resulting flooding causing loss of life, emergency evacuations, and significant property damage.

Nuclear Incidents

Nuclear explosions can cause significant damage and casualties from blast, heat, and radiation. The primary concern following a nuclear accident or nuclear attack is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g., death, burns, severe impairment), chronic health effects (e.g., cancer), and psychological effects.

Opioid/Substance Abuse

Opioid and substance abuse occurs when an individual becomes physically dependent on opioids, which include opiates and narcotics. Opioids are a synthetic substance found in certain prescription pain medications: morphine, codeine, methadone, oxycodone, hydrocodone, fentanyl, and hydromorphone, and street drugs like heroine. Opioids block the body's ability to feel pain and can create a sense of euphoria. Individuals often build a tolerance to opioid drugs, which leads them to take more of the medication than originally prescribed.

Terrorism/Cyberterrorism Incidents

Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear, and radiological weapons. Cyber-attacks have become an increasingly pressing concern. Cyberterrorism refers to acts of terrorism committed using computers, networks, and the internet. The most widely cited definition comes from Denning's Testimony before the Special Oversight Panel on Terrorism: "Cyberterrorism…is generally understood to mean unlawful attacks and threats of attack against computers, networks, and the information stored therein when done to intimidate or coerce a government or its people in furtherance of political or social objectives. Further, to qualify as cyberterrorism, an attack should result in violence against persons or property, or at least cause enough harm to generate fear".

Transportation Accidents

Transportation accidents are technological hazards involving the nation's system of land, sea, and air transportation infrastructure. A flaw or breakdown in any component of this system can and often does result in a major disaster involving loss of life, injuries, property and environmental damage, and economic consequences.

Utility Interruption

Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications and public works and information network sectors. Utility interruption hazards include the following:

- Geomagnetic Storms; including temporary disturbances of the Earth's magnetic field resulting in disruptions of communication, navigation, and satellite systems (National Research Council et al., 1986).
- Fuel or Resource Shortage; resulting from supply chain breaks or secondary to other hazard events, for example.
- Electromagnetic Pulse; originating from an explosion or fluctuating magnetic field and causing damaging current surges in electrical and electronic systems (Institute for Telecommunications Sciences, 1996).
- Information Technology Failure; due to software bugs, viruses, or improper use (Rainer Jr., et al, 1991).
- Ancillary Support Equipment; electrical generating, transmission, system-control, and distribution-system equipment for the energy industry (Hirst & Kirby, 1996).

- Public Works Failure; damage to or failure of highways, flood control systems, deep-water ports and harbors, public buildings, bridges, dams, for example (United States Senate Committee on Environment and Public Works, 2009).
- Telecommunications System Failure; Damage to data transfer, communications, and processing equipment, for example (FEMA, 1997)
- Transmission Facility or Linear Utility Accident; liquefied natural gas leakages, explosions, facility problems, for example (United States Department of Energy, 2005)
- Major Energy, Power, Utility Failure; interruptions of generation and distribution, power outages, for example (United States Department of Energy, 2000).

4.2.3. Climate Change

Impacts of Climate Change on Identified Hazards

Humans have become the dominant species on Earth and our society and influence is globalized. Human activity such as the large-scale consumption of fossil fuels and de-forestation has caused atmospheric carbon dioxide concentrations to significantly increase and a notable diversity of species to go extinct. The result is rapid climate change unparalleled in Earth's history and an extinction event approaching the level of a mass extinction (Barnosky et al., 2011; Wake & Vredenburg, 2008). The corresponding rise of average atmospheric temperatures is intensifying many natural hazards, and further threatening biodiversity. The effects of climate change on these hazards are expected to intensify over time as temperatures continue to rise, so it is prudent to be aware of how climate change is impacting natural hazards.

The most obvious change is in regard to extreme temperature. As average atmospheric temperatures rise, extreme high temperatures become more threatening, with record high temperatures outnumbering record low temperatures 2:1 in recent years. As climate change intensifies, it is expected that the risk of extreme heat will be amplified whereas the risk of extreme cold will be attenuated. Some studies show increased insect activities during a similar rapid warming event in Earth's history. Other studies make projections that with the warming temperatures and lower annual precipitation that are expected with climate change, there will be an expansion of the suitable climate for mosquitos, potentially increasing the risk of disease.

Climate change is likely to increase the risk of droughts (Section 4.3.1). Higher average temperatures mean that more precipitation will fall as rain rather than snow, snow will melt earlier in the spring, and evaporation and transpiration will increase. Along with the prospect of decreased annual precipitation, the risk of hydrological and agricultural drought is expected to increase (Sheffield & Wood, 2008). Correspondingly this will impact wildfires. Drought is accompanied by drier soils and forests, resulting in an elongated wildfire season and more intense and long-burning wildfires (Pechony & Shindell, 2010). However, the Southwest United

States is at a greater risk of this increased drought and wildfire activity than Monroe County in the Eastern United States.

While it may seem counterintuitive considering the increased risk of drought, there is also an increased risk of flooding associated with climate change (Section 4.3.4). As previously mentioned, warmer temperatures mean more precipitation will fall as rain rather than snow. Combined with the fact that warmer air holds more moisture, the result is heavier and more intense rainfalls, increasing the risk of flooding and dam and levee failures. Similarly, winter storms are expected to become more intense, if possibly less frequent (Section 4.3.10). Climate change is also expected to result in more intense hurricanes and tropical storms. With the rise of atmospheric temperatures, ocean surface temperatures are rising, resulting in warmer and more moist conditions where tropical storms develop (Stott et al., 2010). A warmer ocean stores more energy and is capable of fueling stronger storms. It is projected that the Atlantic hurricane season is elongating, and there will be more category 4 and 5 hurricanes than before (Trenberth, 2010).

Climate change is contributing to the introduction of new invasive species (Section 4.3.6). As maximum and minimum seasonal temperatures change, non-native species are able to establish themselves in previously inhospitable climates where they have a competitive advantage. This may shift the dominance of ecosystems in the favor of non-native species, contributing to species loss and the risk of extinction.

This type of sudden global change is novel to humanity. Despite the myriad of well thought out research, there is still much uncertainty surrounding the future of the Earth. All signs point to the intensification of the hazards mentioned above, especially if human society and individuals do not make swift and significant changes to reduce emissions and species losses.

4.3. Hazard Profiles

4.3.1. Drought

4.3.1.1 Location and Extent

While Pennsylvania is generally more water-rich than many U.S. states, the Commonwealth may be subject to drought conditions. A drought is broadly defined as a time period of prolonged dryness that contributes to the depletion of ground and surface water. Droughts are regional climatic events, so when such an event occurs in Monroe County, impacts are not restricted to the county and are often more widespread. The spatial extent of the impacted area can range from localized areas in Pennsylvania to the entire Mid-Atlantic region.

There are three types of drought:

Meteorological Drought – A deficiency of moisture in the atmosphere compared to average conditions. Meteorological drought is defined by the duration of the deficit and degree of dryness

and is often associated with below average rainfall. Depending on the severity of the drought, it may or may not have a significant impact on agriculture and the water supply.

Agricultural Drought – A drought inhibiting the growth of crops, due to a moisture deficiency in the soil. Agricultural drought is linked to meteorological and hydrologic drought.

Hydrologic Drought – A prolonged period without rainfall that has an adverse effect on streams, lakes, and groundwater levels, potentially impacting agriculture.

Leaving areas with little moisture, droughts are often one of the leading contributing factors to wildfires.

Droughts can have adverse effects on farms and other water-dependent industries. This can result in a local economic loss. Areas with extensive agriculture uses are particularly vulnerable to drought; roughly 27,607 acres of Monroe County, or 7% of the 394,880 total land acreage, are held in farms (United States Department of Agriculture [USDA], 2017 Census). Acreage for farming has decreased by 18% since the 2012 USDA Census.

Public safety is an issue in terms of consumable water not being available, as well as water for fire protection and emergency services.

4.3.1.2 Range of Magnitude

Nearly 50% of the annual precipitation of 49 inches is during the spring/summer. Fall is usually the driest. Average snowfall for the county is also 49 inches. Rural farming areas of Monroe County are most at risk when a drought occurs. A drought can be a significant financial burden as approximately 48% of the county farmland use is devoted to crop cultivation and 52% to livestock, poultry, and aquaculture. (U.S. Census of Agriculture, 2017). Wildfires are often the most severe secondary effect associated with drought. Wildfires can devastate wooded and agriculture areas, threatening natural resources, structures near high wildfire loads, and farm production facilities. Prolonged drought conditions can have a lasting impact on the economy and can cause major ecological changes, such as increases in scrub growth, flash flooding and soil erosion.

Table 7 – Drought Preparation Phases shows the FEMA-defined levels of drought severity along with suggested actions, requests, and goals. Drought can cause municipalities to enforce water rationing and distribution.

Table 7 - Drought Preparation Phases

Drought Preparation Phases *(PA DEP, 2017)*				
Phase	**General Activity**	**Actions**	**Request**	**Goal**
Drought Watch	Early stages of planning and alert for drought possibility.	Increased water monitoring, awareness, and preparation for response among government agencies, public water suppliers, water users and the public.	Voluntary water conservation.	Reduce water use by 5%.
Drought Warning	Coordinate a response to imminent drought conditions and potential water shortages.	Reduce shortages - relieve stressed sources, develop new sources if needed.	Continue voluntary water conservation, impose mandatory water use restrictions if needed.	Reduce water use by 10-15%.
Drought Emergency	Management of operations to regulate all available resources and respond to emergency.	Support essential and high priority water uses and avoid unnecessary uses.	Possible restrictions on all nonessential water uses.	Reduce water use by 15%.

Local Water Rationing: Although not a drought phase, local municipalities may, with the approval of the Pennsylvania Emergency Management Council, implement local water rationing to share a rapidly dwindling or severely depleted water supply in designated water supply service areas. These individual water rationing plans, authorized through provisions of 4 PA Code Chapter 120, will require specific limits on individual water consumption to achieve significant reductions in use. Under both mandatory restrictions imposed by the Commonwealth and local water rationing, procedures are provided for granting of variances to consider individual hardships and economic dislocations.

Long-term water shortages during severe drought conditions can have a significant impact on agribusiness, public utilities, and other industries reliant on water for production services.

Monroe County also has a growing agritourism business that would be threatened by long-term drought.

The Commonwealth uses five parameters to assess drought conditions:

- Stream flows (compared to benchmark records);
- Precipitation (measured as the departure from normal, thirty-year average precipitation);
- Reservoir storage levels in a variety of locations such as three New York City reservoirs in the upper Delaware River Basin;
- Groundwater elevations in a number of counties (comparing to past month, past year and historic record); and
- Soil moisture via the Palmer Drought Index (See *Table 8 – Palmer Drought Severity* Index) - a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature.

Table 8 - Palmer Drought Severity Index

Palmer Drought Severity Index	
Severity Category	**PDSI**
Extremely wet	4.0 or more
Very wet	3.0 to 3.99
Moderately wet	2.0 to 2.99
Slightly wet	1.0 to 1.99
Incipient wet spell	0.5 to 0.99
Near normal	0.49 to -0.49
Incipient dry spell	-0.5 to -0.99
Mild drought	-1.0 to -1.99
Moderate drought	-2.0 to -2.99
Severe drought	-3.0 to -3.99
Extreme drought	-4.0 or less

Hydrologic drought events result in a reduction of stream flows, reduction of lake/reservoir storage, and a lowering of groundwater levels. These events have adverse impacts on public

water supplies for human consumption, rural water supplies for livestock consumption and agricultural operations, water quality, natural soil water or irrigation water for agriculture, soil moisture, conditions conducive to wildfire events, and water for navigation and recreation.

The effects of a drought can be far-reaching in both the economic and environmental realms. Economic impacts include the reduced productivity of aquatic resources, mandatory water use restrictions, well failures, cutbacks in industrial production, agricultural losses, and limited recreational opportunities. Environmental impacts of drought include the following:

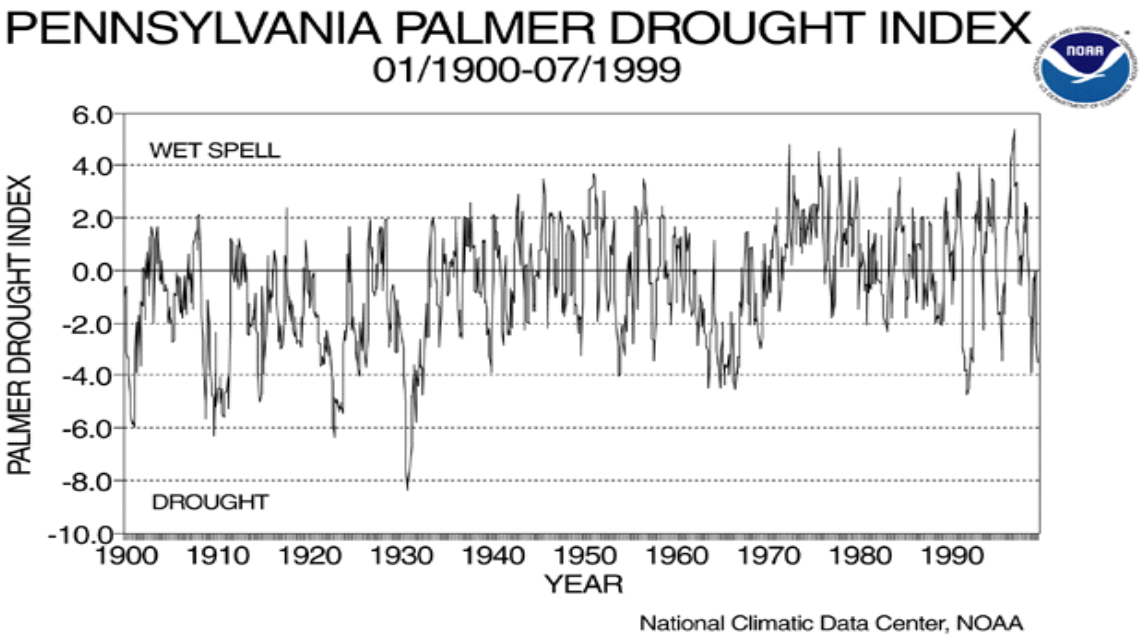
- Hydrologic effects – Lower water levels in reservoirs, lakes, and ponds; reduced stream flow; loss of wetlands; estuarine impacts; groundwater depletion and land subsidence; and effects on water quality, such as increases in salt concentration and water temperature
- Damage to animal species – Lack of feed and drinking water; disease; loss of biodiversity, migration, or concentration; and reduction and degradation of fish and wildlife habitat
- Damage to plant communities – Loss of biodiversity and loss of trees from urban landscapes and wooded conservation areas
- Increased number and severity of fires
- Reduced soil quality
- Air quality effects – Dust and pollutants
- Loss of quality in landscape

4.3.1.3 Past Occurrence

The Department of Environmental Protection (PA DEP) maintains the most comprehensive data on drought occurrences across the Commonwealth. Descriptions of drought status categories (i.e., watch, warning, and emergency) are included in the "Range of Magnitude" section above. The declared drought status from 1980 to 2021 is shown in *Table 9, Past Drought Events in Monroe County (PA DEP, 2020)*.

The National Oceanic and Atmospheric Administration (NOAA) has archived records showing extreme droughts for the Commonwealth in 1931 and a prolonged event in the 1960s; see *Figure 6, Pennsylvania Palmer Drought Index 1900-1999.*

Figure 6 - Pennsylvania Palmer Drought Index - 1900-1999



Based on the county's more recent disaster history and other drought occurrence data, the worst drought event in Monroe County occurred in the summer of 1999. Extended dry weather spurred Governor Ridge to declare a drought emergency in fifty-five counties, including Monroe. During this event, precipitation deficits for that summer averaged 5 - 7 inches; the Susquehanna River hit record low flows, streams were empty, and wells dried up. Crop damages indicated losses of over $500 million statewide, and crop losses totaled 70 – 100%. There were also additional losses from the decline of milk production due to the drought (National Climatic Data Center [NCDC], 2011). Additionally, during this event, the state asked municipal and private water suppliers to cut local water use.

Table 9 - Past Drought Events in Monroe County (PA DEP, 2020)

Past Drought Events in Monroe County			
Dates	**Drought Status**	**Dates**	**Drought Status**
11/18/1980 - 04/20/1982	Emergency	12/03/1998 - 12/14/1998	Watch
11/10/1982 - 02/08/1983	Warning	07/20/1999 - 09/30/1999	Emergency
02/08/1983 - 03/28/1983	Warning	09/30/1999 - 12/05/2001	Watch
01/23/1985 - 04/26/1985	Warning	12/05/2001 - 02/12/2002	Warning
04/26/1985 - 12/19/1985	Emergency	02/12/2002 - 05/13/2002	Emergency

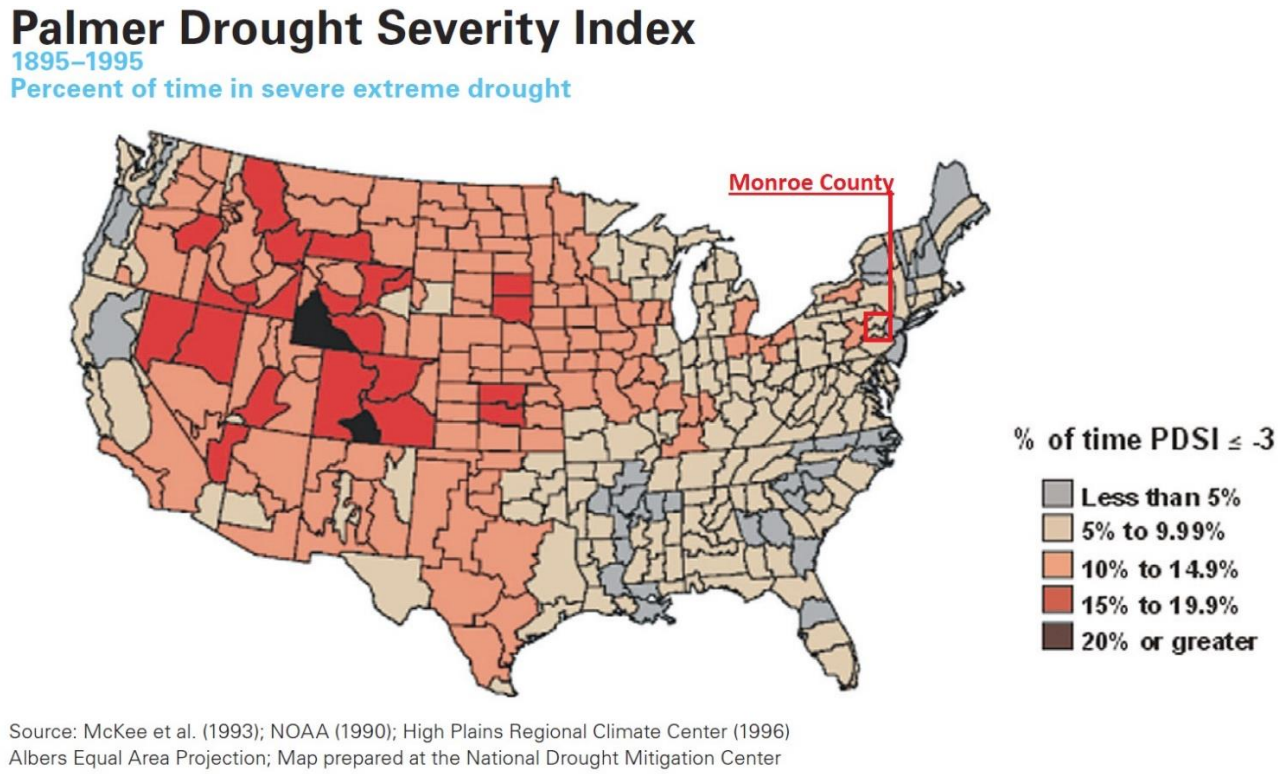
Dates	Drought Status	Dates	Drought Status
07/07/1988 - 12/12/1988	Watch	05/13/2002 - 11/07/2002	Watch
03/03/1989 - 05/15/1989	Warning	04/11/2006 - 06/30/2006	Watch
07/24/1991 - 04/20/1992	Emergency	08/08/2007 - 01/11/2008	Watch
04/20/1992 - 06/23/1992	Warning	09/16/2010 - 11/10/2010	Warning
09/01/1995 - 09/20/1995	Warning	03/24/2015 - 07/10/2015	Watch
09/20/1995 - 12/18/1995	Emergency	11/03/2016 - 02/14/2017	Warning
10/27/1997 - 01/16/1998	Warning	02/14/2017 - 04/06/2017	Watch

Pennsylvania had its warmest July on record in 2020, and twenty-nine counties, including Monroe, entered Drought Watch status on September 30, 2020. At the writing of this plan, however, drought watches had been lifted for all Commonwealth counties.

4.3.1.4 Future Occurrence

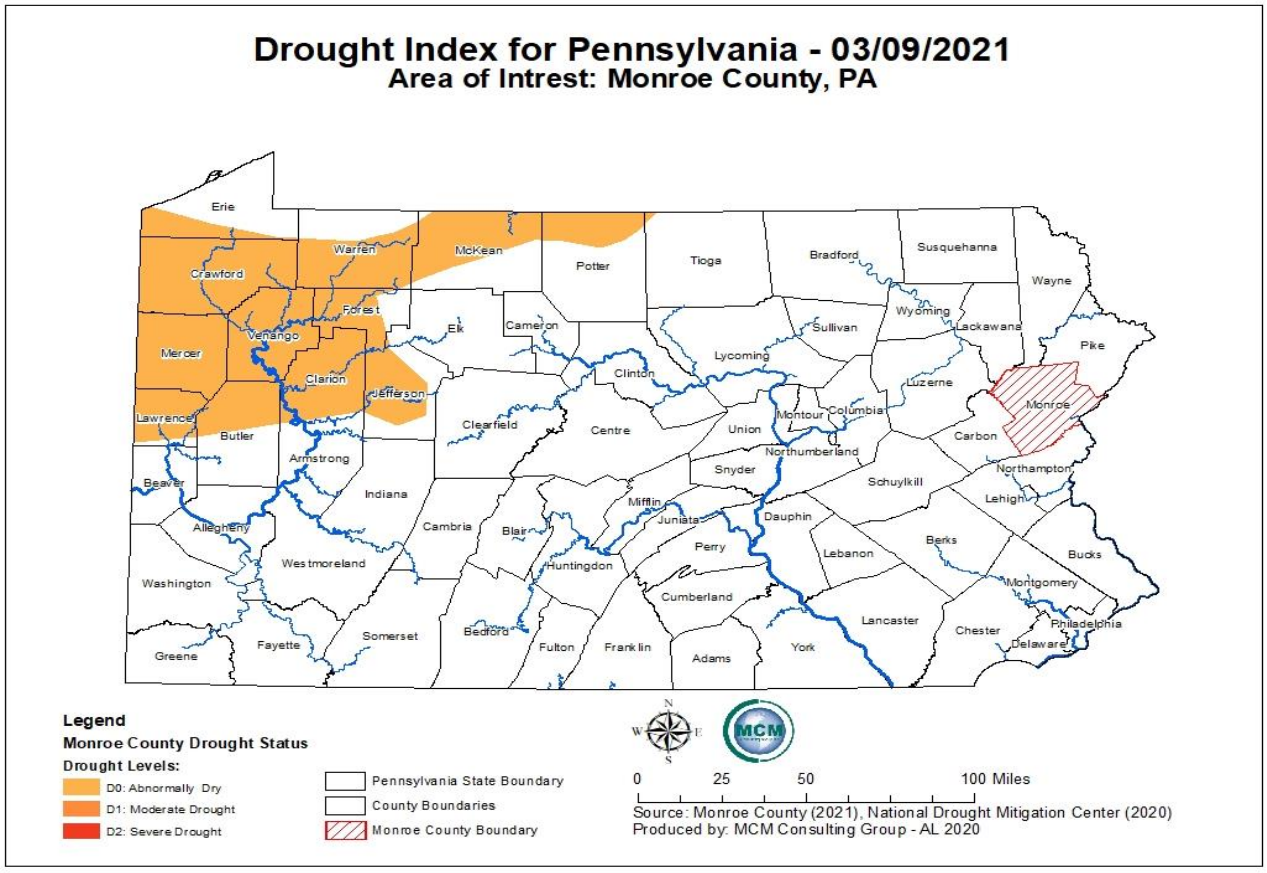
It is difficult to forecast the exact severity and frequency of future drought events and the future of climate change will lead to increased uncertainty and extremity of climate events, suggesting that it is best to be prepared for potentially adverse conditions. As Monroe County has experienced severe drought between 5% - 10% of the time between 1895 and 1995 (*Figure 7 – Palmer Drought Severity Index*– a 100-year data collection*)*, the report can be used to make a rough estimate of the future probability of drought in Monroe County, although it does not account for changes introduced by climate change. Drought conditions are expected to become more severe with climate change, as evaporation and transpiration will increase with higher temperatures (Sheffield & Wood, 2008; EPA, 2016).

Figure 7 - Palmer Drought Severity Index



Source: McKee et al. (1993); NOAA (1990); High Plains Regional Climate Center (1996)
Albers Equal Area Projection; Map prepared at the National Drought Mitigation Center

Figure 8 - Current Drought Index for Pennsylvania



The potential for a drought to occur in Monroe County is, nevertheless, high. Given the frequency of drought watches issued for Monroe County and its municipalities, the county can reasonably expect to be under a drought watch at least once per year. While some form of drought condition frequently exists in Monroe County, the impact depends on the duration of the event, severity of conditions, and area affected. The map above shows that Monroe County and most of Pennsylvania is currently in normal (non-drought) conditions.

4.3.1.5 Vulnerability Assessment

Drought vulnerability depends on the duration and area of impact. However, other factors contribute to the severity of a drought. Unseasonably high temperatures, prolonged winds, and low humidity can heighten the impact of a drought.

Extended periods of drought can lead to lowered stream levels, altering the delicate balance of riverine ecosystems. Certain tree species are susceptible to fungal infections during prolonged periods of soil moisture deficit. Fall droughts pose a particular threat because groundwater levels are typically at their lowest following the height of the summer growing season.

Wildfire is the most severe secondary effect associated with drought. Wildfires can devastate

wooded and agricultural areas, threatening natural resources and farm production facilities.

Prolonged drought conditions can cause major ecological changes, such as increases in scrub growth, flash flooding, and soil erosion.

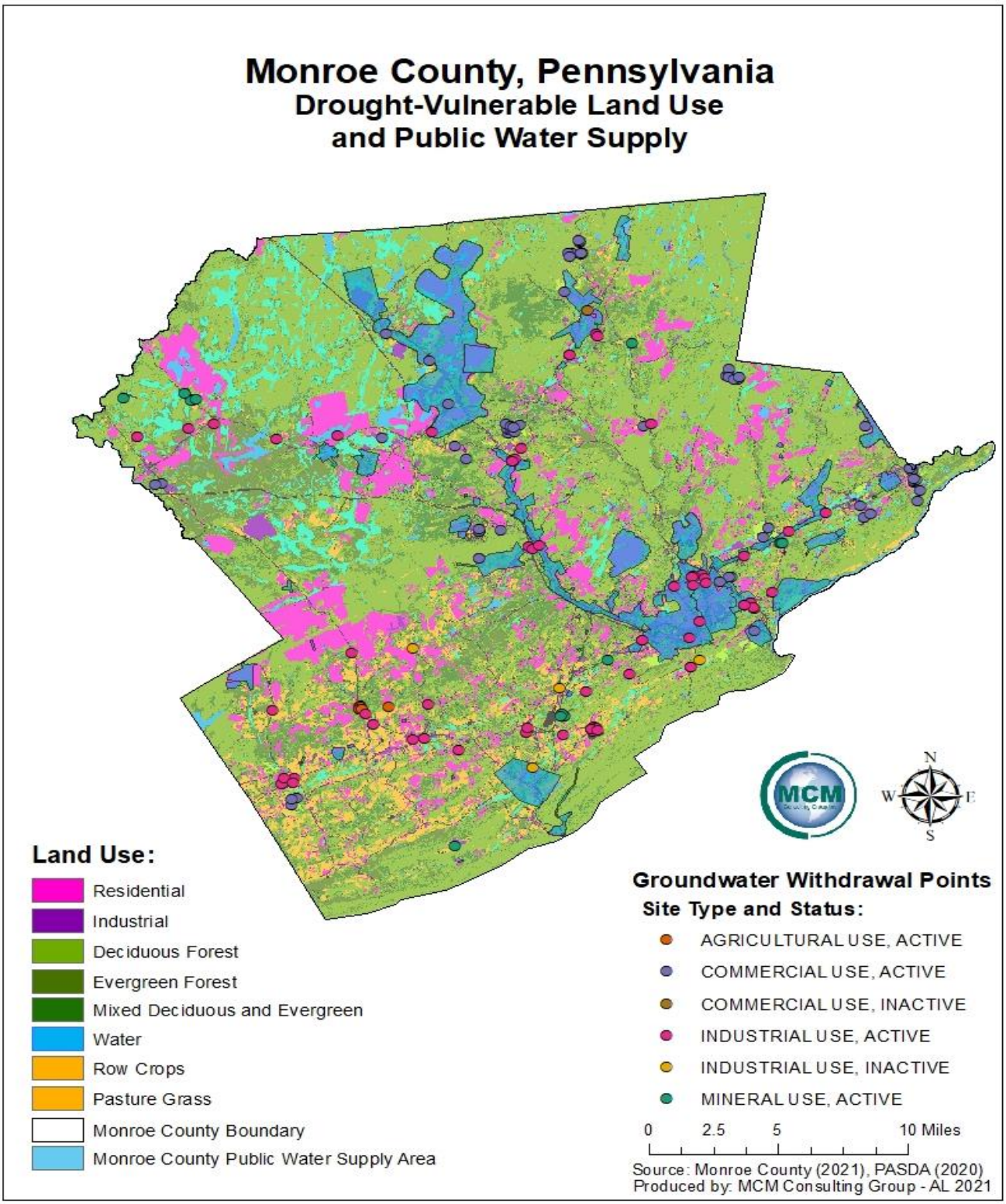
Droughts can have adverse effects on farms and other water-dependent industries. This can result in a local economic loss. The 2017 U.S. Census of Agriculture lists over 27,607 acres of prime agricultural land in Monroe County and there are multiple recreational sites across the county dependent on consistent water sources and replenishment. From a societal perspective, public safety is an issue in terms of consumable water not being available, as well as water for fire protection and emergency services.

The most significant losses resulting from drought events are typically found in the agriculture and aquaculture sectors. The 1999 Gubernatorial Proclamation was issued in large part due to significant crop damage. Preliminary estimates by the Pennsylvania Department of Agriculture indicated possible crop losses across the Commonwealth in excess of $500 million. This estimate did not include a 20% decrease in dairy milk production which also resulted in million-dollar losses (NCDC, 2009).

While these were statewide impacts, they illustrate the potential for droughts to severely impair the local economy in more agricultural communities. The 2017 Census of Agriculture reports there were 233 farms in Monroe County, at an average size of 118 acres. Monroe County ranks 60th of sixty-seven counties (down from the ranking of 57th reported in the 2016 hazard mitigation plan) in the Commonwealth for agricultural production, totaling just under $10 million annually (USDA, 2017). Agricultural production from aquaculture and crops, including nursery and greenhouse crops, accounts for $6,421,000.00 in commerce annually. Production from livestock, poultry, and their products accounts for $3,511,000.00 annually.

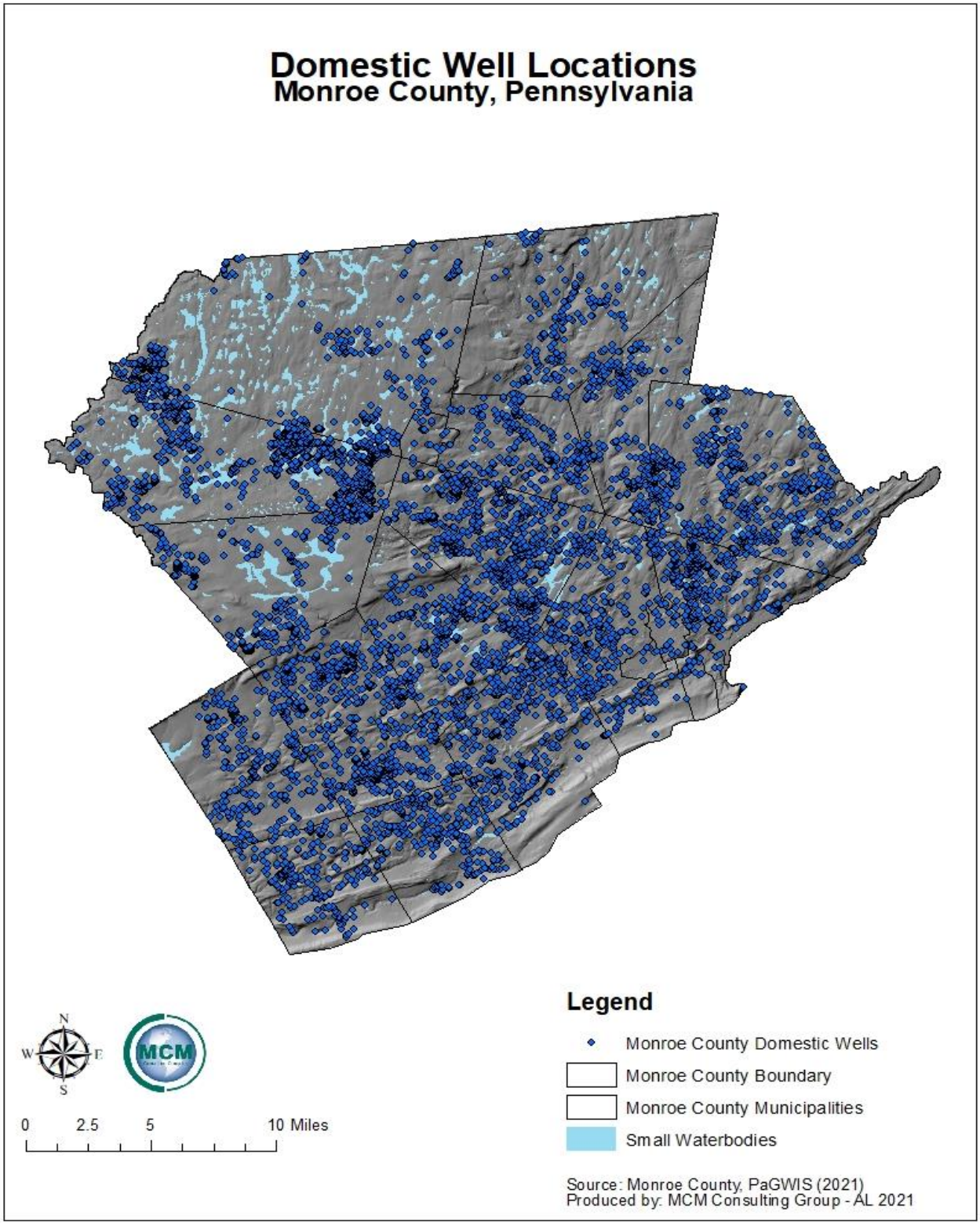
A map of properties with tillable agricultural land use, forestry, and other land in the county vulnerable to drought is shown below at *Figure 9, Drought-Vulnerable Land Use and Public Water Supply.*

Figure 9 - Drought Vulnerable Land Use and Public Water Supply



Public or municipal water supplies are also vulnerable to the effects of drought because supply sources include rivers, reservoirs, and groundwater. Public water service areas cover only some of the land area in the county, as depicted in *Figure 10 – Domestic Well Locations - Monroe County.* The majority of the county relies on domestic wells for their fresh drinking water. Residents or water authorities that use private domestic wells are more vulnerable to droughts because their drinking water can literally dry up. There is a total of 19,681 domestic wells in the county. It is important to note that the well data was obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS relies on *voluntary submissions* of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the county. This is the most complete dataset of domestic wells available.

Figure 10 - Domestic Well Locations - Monroe County



Through 2017, the USGS conducted many baseline water quality studies throughout Pennsylvania, but one for Monroe County is not yet completed. The studies comprise a useful reference to get a general sense of the water quality and challenges associated with domestic water wells in the Commonwealth.

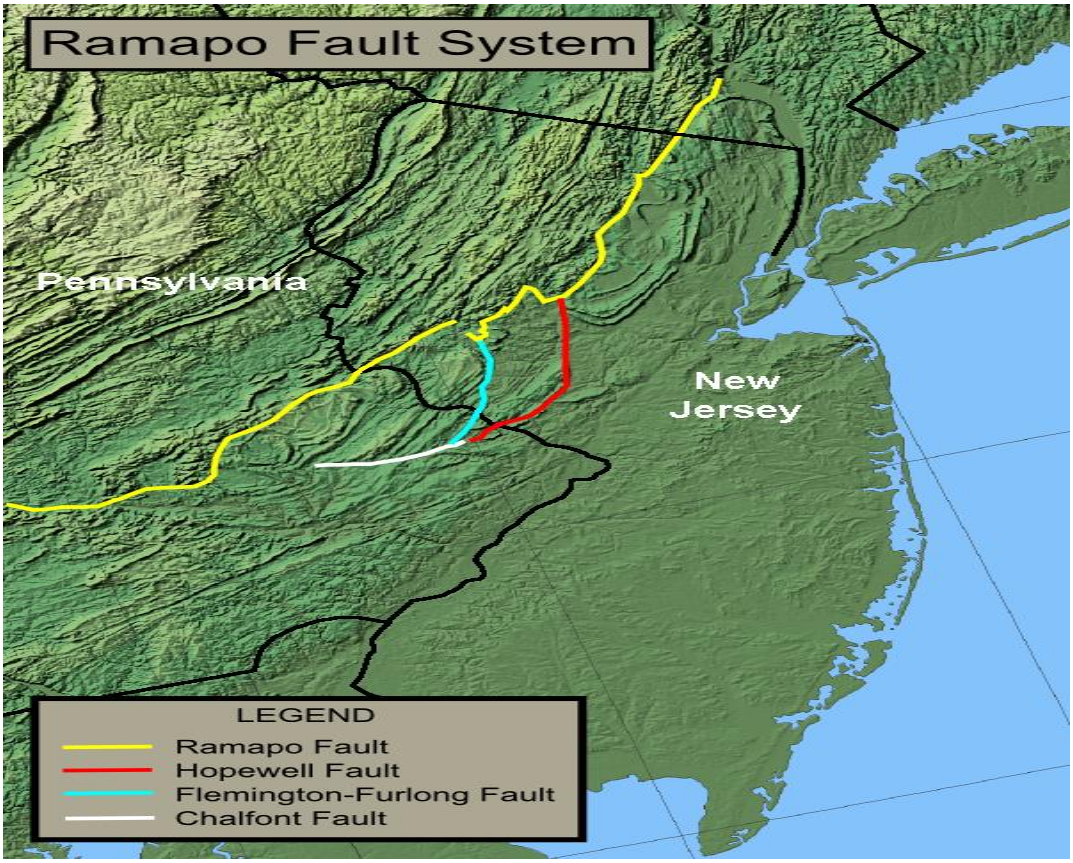
The EPA provides a guide published in October 2017 for water utilities to aid in drought response and recovery. The guide outlines what goes into a good drought response plan, how to manage water supply and demand during a drought, best practices for communication and partnerships with other local utilities and provides case studies to discuss examples of drought management practices (EPA, 2017). The guide may be found here: https://www.epa.gov/sites/production/files/2017-10/documents/drought_guide_final_508compliant_october2017.pdf.

4.3.2. Earthquake

4.3.2.1 Location and Extent

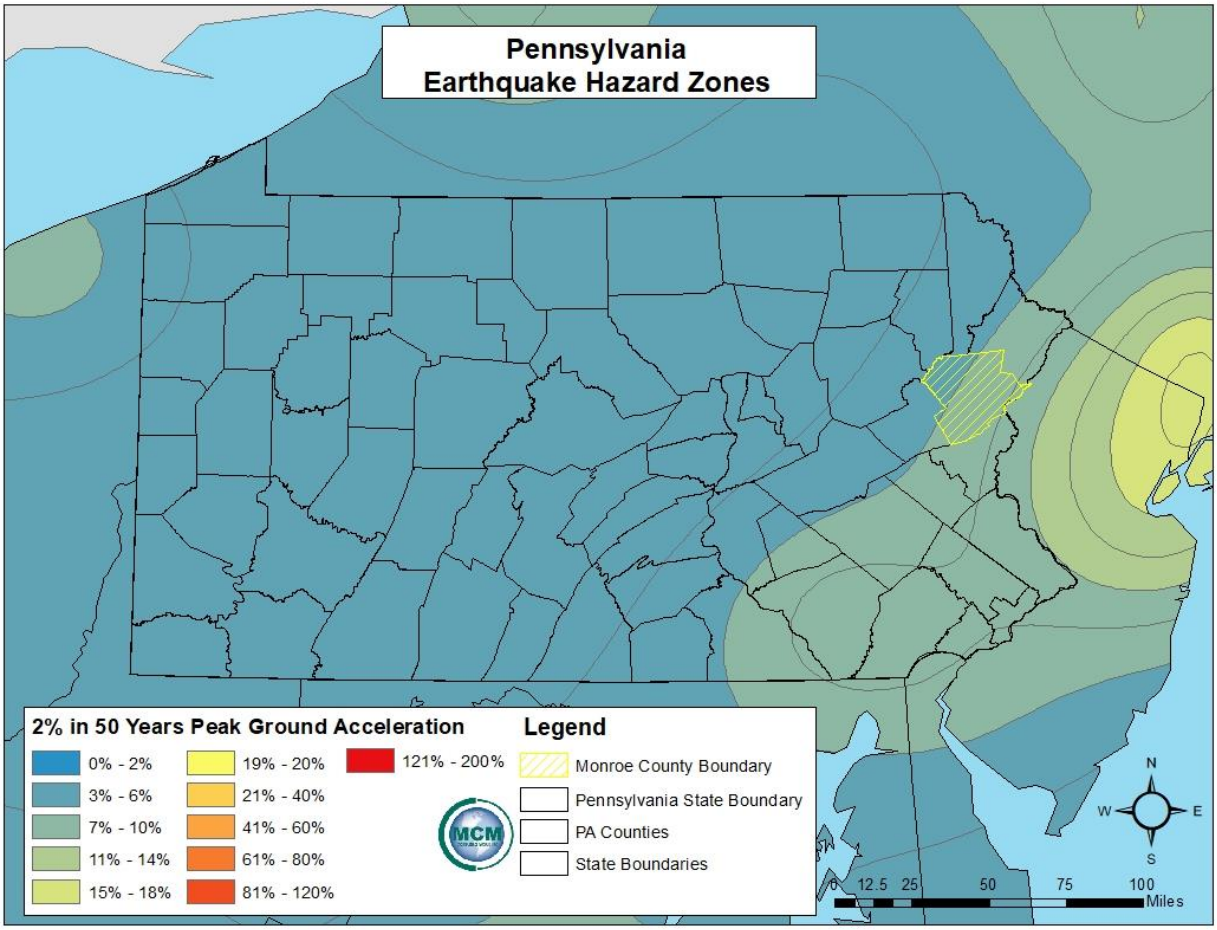
An earthquake is sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge off the earth's tectonic plates, a volcanic eruption, or by a human induced explosion (DCNR, 2007). Earthquake events in Pennsylvania, including Monroe County, are usually mild events, impacting areas no greater than 62 miles in diameter from the epicenter. A majority of earthquakes occur along boundaries between tectonic plates, and some earthquakes occur at faults on the interior of plates. Today, Eastern North America, including Monroe County, Pennsylvania, is far from the nearest plate boundary. That plate boundary is the Mid-Atlantic Ridge and is approximately 2,000 miles to the east. The Ramapo Fault System runs through New York, New Jersey, and eastern Pennsylvania (See *Figure 11 – Ramapo Fault System*). This fault system is associated with some small earthquakes, and it is thought unlikely to produce large earthquakes.

Figure 11 - Ramapo Fault System



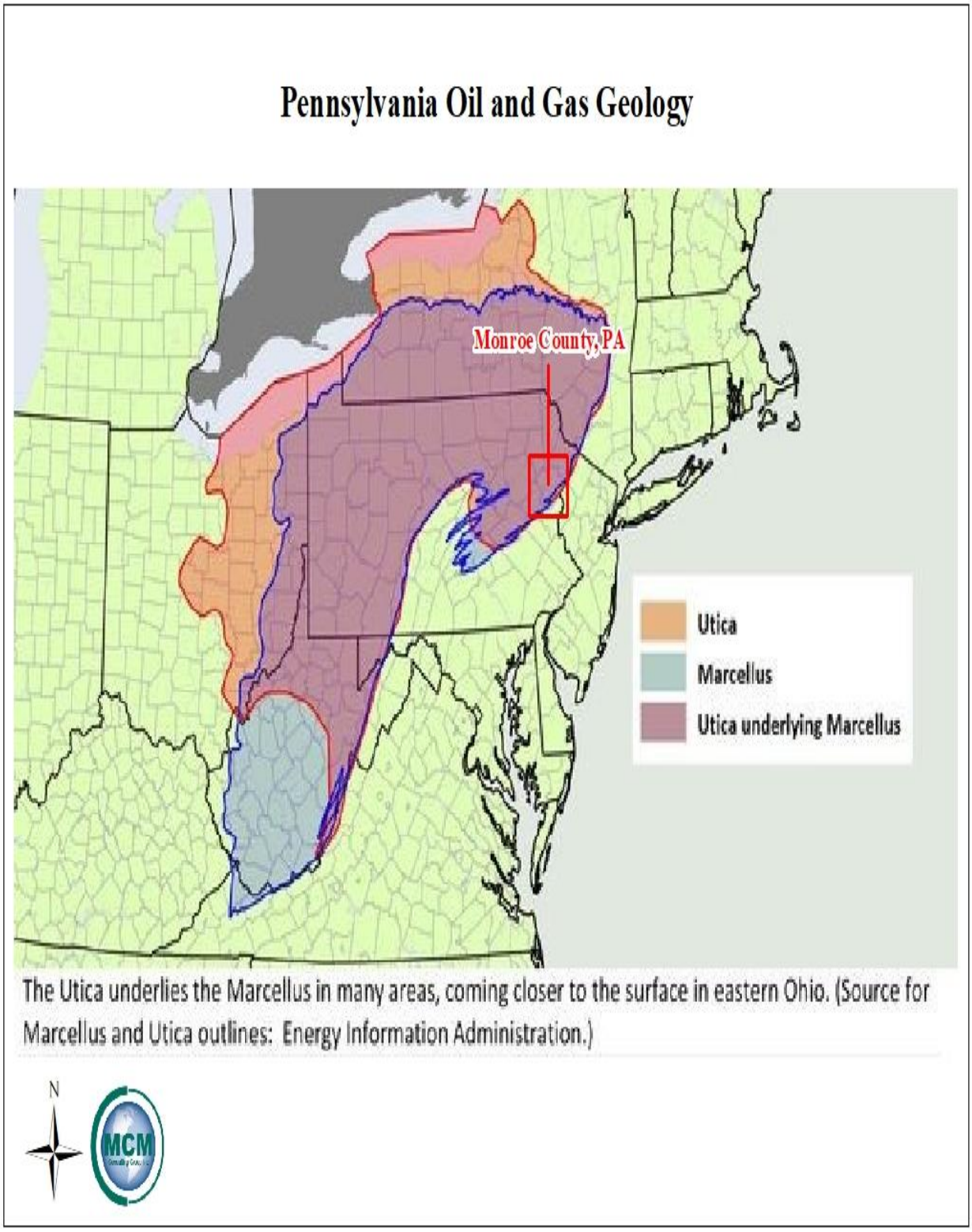
When the supercontinent of Pangaea broke apart about 200 million years ago, the Atlantic Ocean began to form. Since then, many faults have developed. Locating all of the faults would be an idealistic approach to identifying the region's earthquake hazard; however, many of the fault lines in this region have no seismicity associated with them. The best way to determine earthquake history for Monroe County is to conduct a probabilistic earthquake-hazard analysis with the earthquakes that have already happened in and around the county. (See *Figure 12 – Pennsylvania Earthquake Hazard Zones*). Nevertheless, the United States Geological Survey (USGS) states that Monroe County has a low earthquake risk, and no historical earthquake events that had recorded magnitudes of 3.5 or above since 1931. However, the map shown as *Figure 14 - Earthquake Epicenters Within 200 Miles of Monroe County,* shows one earthquake occurrence inside the county boundary. Perhaps the earthquake was not listed in text references because it was recorded as a 3.4 magnitude event (Stroud Township, October 24, 1941).

Figure 12 - Pennsylvania Earthquake Hazard Zones



Natural gas extraction of the Marcellus/Utica Shale formation (see *Figure 13, Pennsylvania Oil and Gas Geology*) has occurred in many regions of the Commonwealth, but eastern and southeastern Pennsylvania are not among them. Hydraulic fracturing, or fracking, is used to extract the gas, and the process is thought to lead to an increase in seismic activity (Meyer, 2016).

Figure 13 - Pennsylvania Oil and Gas Geology



However, fracking does not appear to be linked to the increased rate of magnitude three and larger earthquakes (USGS 2014). In recent years, permits for extraction of the natural gas and oil in the Commonwealth have been issued by the Pennsylvania Department of Environmental Protection, but no records of requested permits for gas extraction or injection wells were found for Monroe County at the writing of this plan.

4.3.2.2 Range of Magnitude

Earthquakes result in the propagation of seismic waves, which are detected using seismographs. These seismograph results are measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. *Table 10 – Richter Scale* summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. The Modified Mercalli Intensity Scale (*Table 11 – Modified Mercalli Intensity Scale*) is an alternative measure of earthquake intensity that is scaled by the impacts of the earthquake event. Earthquakes have many secondary impacts, including disrupting critical facilities, transportation routes, public water supplies and other utilities.

Table 10 - Richter Scale

Richter Scale	
Richter Magnitude	**Earthquake Effects**
Less than 3.5	Not generally felt but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas where people live up to about 100 kilometers across.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

Table 11 - Modified Mercalli Intensity Scale

Modified Mercalli Intensity Scale			
Scale	**Intensity**	**Earthquake Effects**	**Richter Scale Magnitude**
I	**Instrumental**	Detected only on seismographs.	<4.2
II	**Feeble**	Some people feel it.	
III	**Slight**	Felt by people resting, like a truck rumbling by.	
IV	**Moderate**	Felt by people walking.	
V	**Slightly Strong**	Sleepers awake; church bells ring.	<4.8
VI	**Strong**	Trees sway; suspended objects swing; objects fall off shelves.	<5.4
VII	**Very Strong**	Mild alarm, walls crack, plaster falls.	<6.1
VIII	**Destructive**	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged.	<6.9
IX	**Ruinous**	Some houses collapse, ground cracks, pipes break open.	
X	**Disastrous**	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread.	<7.3
XI	**Very Disastrous**	Most buildings and bridges collapse, roads, railways, pipes, and cables destroyed, general triggering of other hazards.	<8.1
XII	**Catastrophic**	Total destruction, trees fall, ground rises and falls in waves.	>8.1

4.3.2.3 Past Occurrence

According to *Figure 14- Earthquake Epicenters Within 200 Miles of Monroe County,* an earthquake with a magnitude of 3.4 took place in 1941 in Stroud Township. Both *Figure 14* and the one at the following hyperlink show earthquake epicenters within close enough proximity to the county to produce some effects in the county:

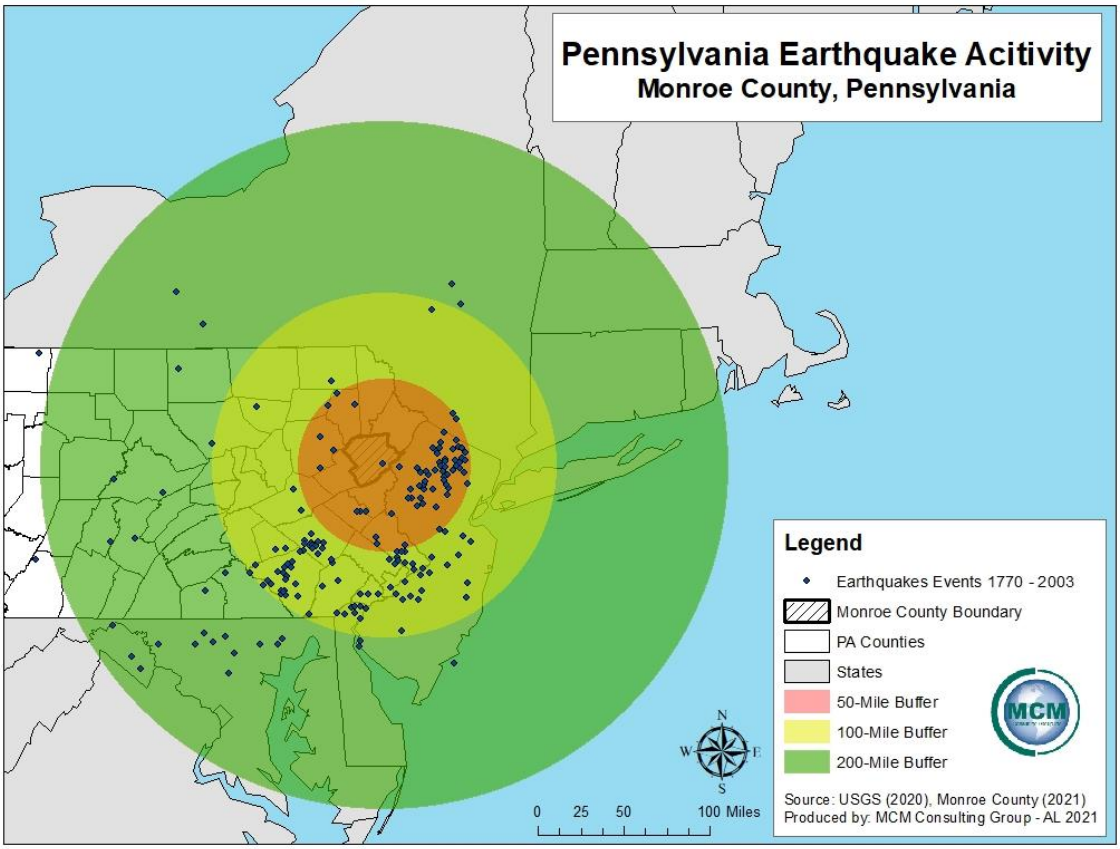
http://elibrary.dcnr.pa.gov/GetDocument?docId=1751247&DocName=Map69_EQCatalog-Epicenter_Pa

On August 23, 2011, a 5.9 earthquake occurred in Virginia and in July 2019, a 2.2 earthquake occurred just west of Reading. Parts of the county experienced some of the shock waves from these minor earthquakes and others that have occurred around the region, most notably New Jersey. The strongest recorded earthquake in Pennsylvania history (5.2) occurred on September 25, 1998 in northwestern Pennsylvania and is known as the Pymatuning Earthquake for its epicenter near Pymatuning Lake. The effects of the earthquake were felt across the Commonwealth and were blamed for many wells in the epicentral region drying up, while new springs and old wells began to flow. A three-month date range revealed 120 dry household-supply wells on the ridge of Jamestown and Greenville, Pennsylvania. Declines of up to 100 feet were observed on a ridge where at least eighty of the wells resided. The degree of the damage varied. Some of the wells lost all power or could barely hold their yields and some of the water in wells turned black or began to smell of sulfur.

The most likely cause of the wells drying was because of the increase in hydraulic conductivity or "fracking" of shale rock under this area caused by the earthquake. The quake affected the existing faults and created new faults in the shale. This created more permeability for the water to leak down from the hilltops on the ridge down to the valleys following the contours of the Meadville shale.

Because the effects of large earthquakes can be felt hundreds of miles away, the historical earthquake epicenters *near* Monroe County are shown below at *Figure 14 - Earthquake Epicenters Within 200 Miles of Monroe County.* A wider depiction of earthquake occurrences in the northeastern United States may be found here: *https://earthquake.usgs.gov/earthquakes/map/?extent=14.26438,-141.32813&extent=56.51102,-48.60352*

Figure 14 - Earthquake Epicenters Within 200 Miles of Monroe County



4.3.2.4 Future Occurrence

Earthquake activity and intensities are difficult to predict, but a probabilistic analysis of prior earthquakes can assist in gauging the likelihood of future occurrences. *Figure 12 – Pennsylvania Earthquake Hazard Zones* above shows that Monroe County is in a low hazard zone (14-18%) for earthquake activity according to the USGS (2014), suggesting a low probability of earthquake occurrence. However, according to the USGS, there has been a recent trend increasing the frequency of magnitude three and larger earthquakes in the central and eastern U.S. (*Table 12 - Recent Earthquake Trends in Northeastern United States*). This uptick in seismicity is considered to be due to hydraulic fracturing activities, and specifically occurs as a result of wastewater from the fracking process being injected into the earth (Meyer, 2016). Recent studies have moved towards being able to predict such induced seismicity by looking at uplift after injections, but more work needs to be done to confirm uplift as a reliable indicator of induced seismicity (Shirzei et al., 2016). It is important to note that seismicity can occur even after wells become inactive and injection rates decline (Shirzaei et al., 2016).

Isostatic Rebound is a hypothesis for earthquake occurrence that has been kicked around for a lot of years, according to Charles Scharnberger, a retired professor of geology at Millersville

University, who monitors the seismic station there. Scharnberger said Pennsylvania earthquakes are more of a mystery but could have something to do with the westward shift of the North American tectonic plate. Though the plates meet in California, where most of the seismic activity occurs, that movement still causes stress, squeezing and pressure along the entire length of the plate, reverberating as far back as the East Coast. A 3.4 earthquake like the one in Mifflintown, Juniata County in 2019 is in the medium range for Pennsylvania and may occur every couple of years. According to the USGS, this was the strongest earthquake felt or originating in Pennsylvania that year. It was followed by a 1.3 aftershock.

The chances of a devastating earthquake are low, but do exist, according to Scharnberger, His calculations on the probability of a severe earthquake based on the historic record indicate it is about a one in 200 chance in any given year.

Table 12 - Recent Earthquake Trends in Northeastern United States

Earthquake Trends in Northeastern U.S. *(USGS, 2020)*	
Year	**Number of Magnitude 3+ Earthquakes**
2015	0
2016	3
2017	4
2018	0
2019	5
2020	3

4.3.2.5 Vulnerability Assessment

According to the U.S. Geological Society Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect a resident's normal activities. For Monroe County, this could include surface faulting, ground shaking, landslides, liquefaction, dried up or rejuvenated water wells, tectonic deformation, and seiches (sloshing of a closed body of water from earthquake shaking).

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin (epicenter). Ground shaking is the greatest risk to building damage within Monroe County. Risk to public safety and loss of life from an earthquake is dependent upon the severity and proximity of the event. Injury or death to those inside buildings, or people walking below building ornamentation and chimneys is a higher risk to Monroe County's general public during

an earthquake. Infrastructure is more at risk on the east coast than the west coast because its buildings are older.

4.3.3. Extreme Temperatures

4.3.3.1 Location and Extent

Pennsylvania, and more specifically, Monroe County can experience many different temperature extremes. High temperatures occur about ten days per year at any location in Pennsylvania, however, southern parts of the state experience more than twice this number. Freezing temperatures occur on an average of 100 or more days per year with longest freeze-free period at near sea level locations, such as Monroe County, and northwest Pennsylvania (adjacent to Lake Erie). Extreme temperatures can be devastating – extreme heat can cause sunburn, heat cramps, heat exhaustion, heat stroke, and dehydration, while extreme cold can cause hypothermia and frostbite. Both can potentially cause long-lasting disabilities. January is typically the coldest month for Monroe County, with average temperatures of 16°F. *Figure 15 - Average Minimum Temperature Trends for Pennsylvania* shows the average minimum temperatures in Pennsylvania with Monroe County identified. July has typically been the warmest month for Monroe County, with an average temperature of 82°F. *Figure 16 - Average Maximum Temperature Trends for Pennsylvania* shows the average maximum temperatures in Pennsylvania with Monroe County identified. Temperatures can vary across Monroe County due to elevation changes in topography.

Figure 15 - Average Minimum Temperature Trends for Pennsylvania

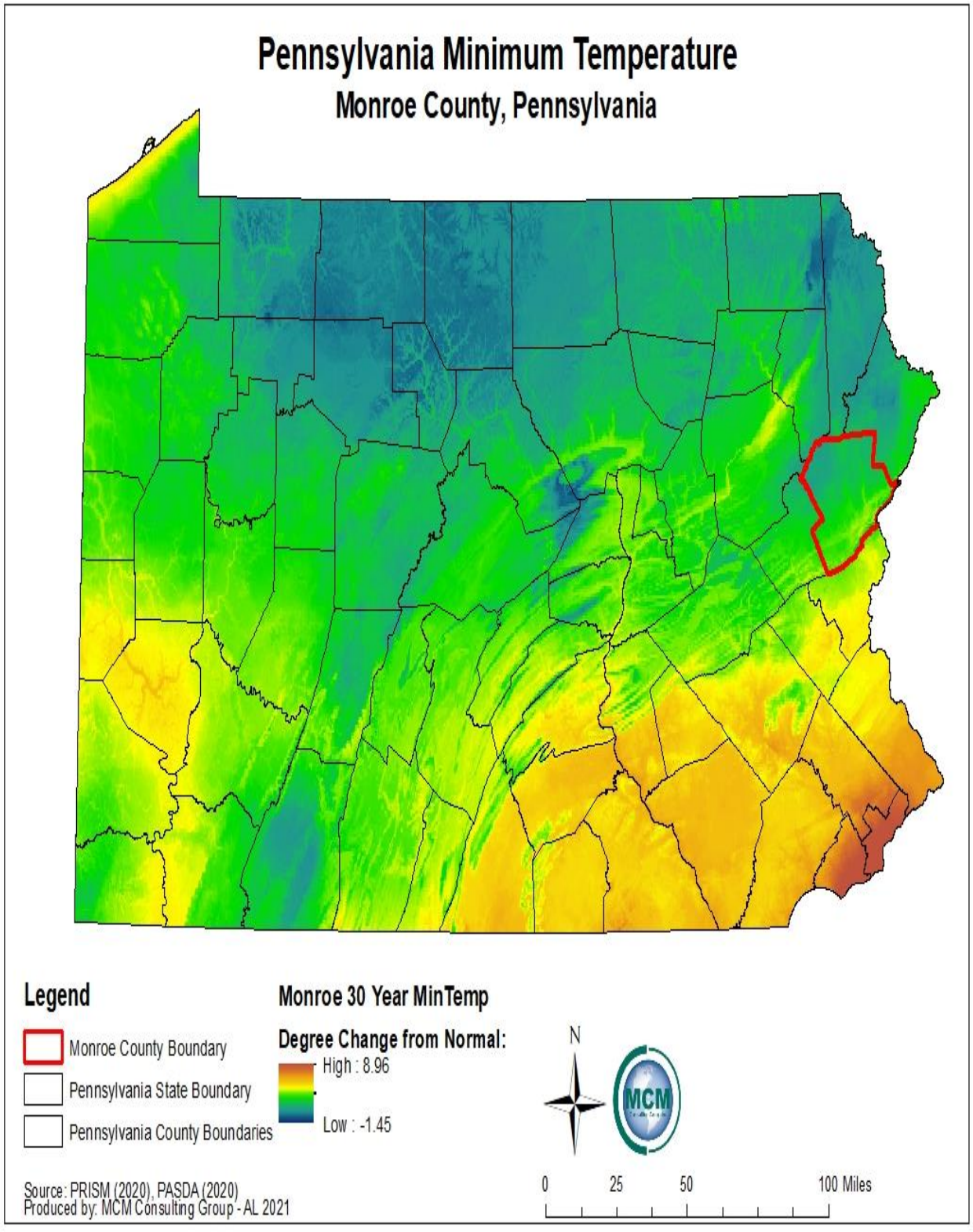
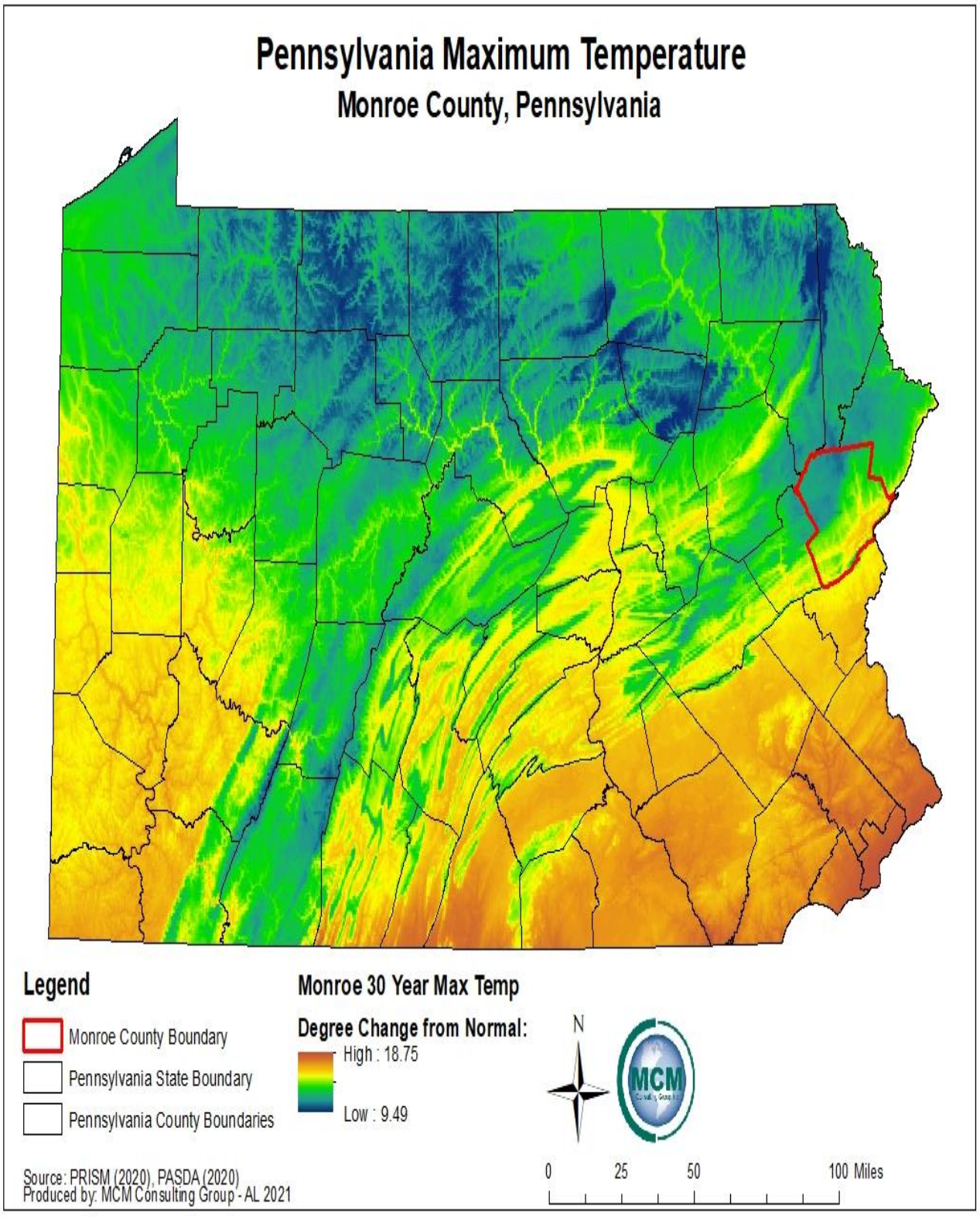


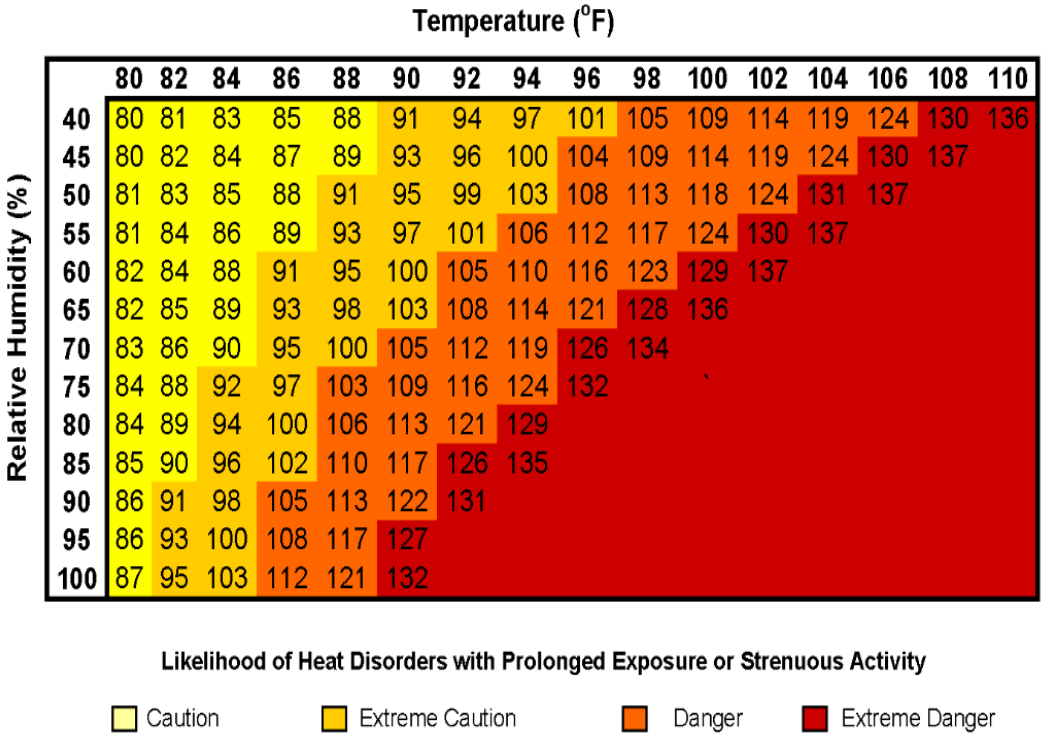
Figure 16 - Average Maximum Temperature Trends for Pennsylvania



4.3.3.2 Range of Magnitude

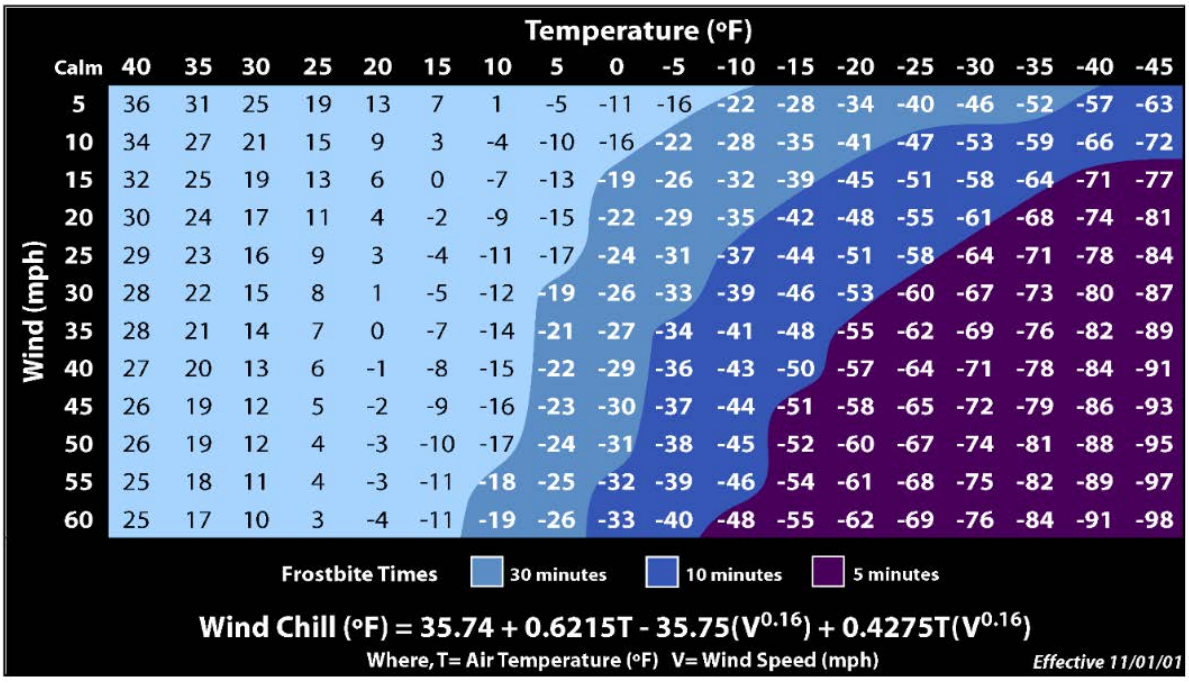
When extreme temperature events occur, they typically impact the entirety of Monroe County, including the surrounding region. Extreme heat is described as temperatures that hover at least 10ºF above the average high temperature for a region during the summer months. Extreme heat is responsible for more deaths in Pennsylvania than all other natural disasters combined. Temperature advisories, watches, and warnings are issued by the National Weather Service relating impacts to the range of temperatures typically experienced in Pennsylvania. Heat advisories are issued when the heat index temperature is expected to be equal to 100°F, but less than 105°F. Excessive heat warnings are issued when heat indices will attain or exceed 105°F and are issued within twelve hours of the onset. Excessive heat watches are issued when there is a possibility that excessive heat warning criteria may be experienced within twenty-four to seventy-two hours, but their occurrence and timing are still uncertain. A potential worst-case extreme temperature scenario would be widespread areas of the Commonwealth experiencing 90°F or higher temperatures for an extended number of days. The heat could overwhelm the power grid and cause widespread blackouts, cutting off vital HVAC services for residents. It could create crisis management issues for senior citizens on fixed incomes and the homeless population. The heat index is a measurement that takes into account both the temperature and relative humidity and is calculated as shown in *Figure 17 - National Weather Service's Heat Index Matrix.*

Figure 17 - National Weather Service's Heat Index Matrix



Cold temperatures can be extremely dangerous to humans and animals exposed to the elements. Without heat and shelter, cold temperatures can cause hypothermia, frost bite, and death. Extreme cold temperatures drop well below typical temperatures and are often associated with winter storm events. Wind can make the apparent temperature drop further, and exposure to such extreme cold temperatures can cause hypothermia, frost bite and death. Wind chill warnings are issued when wind chills drop to -25°F or lower. While this threshold applies to the entire state, the threshold for advisories varies based on regions. Wind chill advisories are issued in the south and western sections of Pennsylvania, when wind chill values drop to -10°F to -24°F. Wind chill advisories are issued in the southern-central to northern sections of the Commonwealth when wind chills drop to -15°F to -24°F. The National Weather Service created a wind chill chart which shows the time frostbite takes to set in depending on temperature and wind speed as shown in *Figure 18 - National Weather Service's Wind Chill Matrix*.

Figure 18 - National Weather Service's Wind Chill Matrix



Source: (NOAA NWS, 2001)

4.3.3.3 Past Occurrence

Monroe County has had more past occurrences of extreme cold incidents than extreme heat due to the geographic location of the county. *Table 13 - Past Extreme Temperature Occurrences for Monroe County* shows the past occurrence events associated with extreme temperature (hot and

cold) that have occurred in Monroe County. The data in the table was reported from early 2000s to the year 2015. Due to the source used, no further events have been documented since 2015, however, events most likely have occurred without being documented. With a total of eighteen different extreme temperature events that have occurred, thirteen of the events were extreme cold related while the remaining five were extreme heat related. There were no reports of death or injury related to the occurrences. However, numerous sources have provided information in regard to past occurrences and losses associated with extreme temperature in Monroe County and the Commonwealth as a whole. Due to the number of sources available with information, number of events and losses could vary slightly in number.

Data from the National Climatic Data Center reports that there have been eighty-five extreme temperature episodes in Pennsylvania from 2000 to present, resulting in a total of ninety-four deaths and 103 injuries. Out of the eighty-five events, fifty of them were extreme cold related with four deaths. The other thirty-five events were extreme heat related with ninety deaths and 103 injuries across the state. The biggest event was on June 21st, 2011, which had a huge effect on Monroe County itself. In the 2011 event, there was a total of twenty-five deaths and sixty injuries within one day. Record-breaking heat temperatures were experienced in nineteen different counties.

Table 13 - Past Extreme Temperature Occurrences for Monroe County

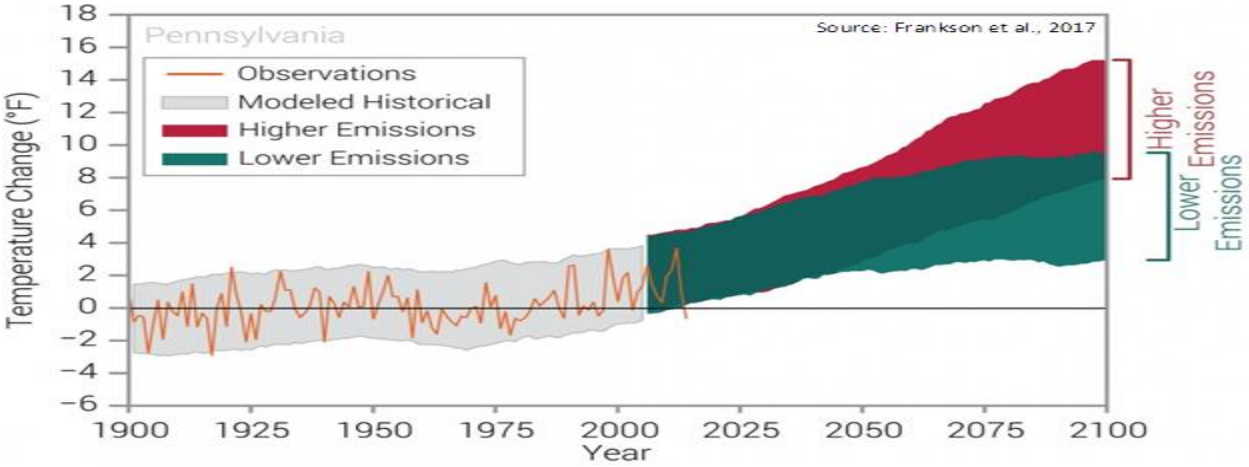
Past Extreme Temperature Occurrences for Monroe County (NOAA, 2020)		
Location	**Date**	**Type**
Monroe County	05/02/2001	Extreme Heat
Monroe County	01/26/2007	Extreme Cold
Monroe County	02/05/2007	Extreme Cold
Monroe County	02/06/2007	Extreme Cold
Monroe County	06/07/2008	Extreme Heat
Monroe County	07/16/2008	Extreme Heat
Monroe County	07/06/2010	Extreme Heat
Monroe County	07/21/2011	Extreme Heat
Monroe County	01/04/2014	Extreme Cold
Monroe County	01/07/2014	Extreme Cold
Monroe County	01/22/2014	Extreme Cold
Monroe County	01/07/2015	Extreme Cold
Monroe County	02/13/2015	Extreme Cold
Monroe County	02/15/2015	Extreme Cold
Monroe County	02/15/2015	Extreme Cold
Monroe County	02/19/2015	Extreme Cold

Past Extreme Temperature Occurrences for Monroe County (NOAA, 2020)		
Location	**Date**	**Type**
Monroe County	02/24/2015	Extreme Cold
Monroe County	02/13/2015	Extreme Cold

4.3.3.4 Future Occurrence

Extreme temperatures will continue to impact Monroe County in the future. Anthropogenic climate change is causing extreme climatic events to occur more frequently, suggesting that extreme temperatures are becoming a more threatening hazard as the impacts of climate change intensify. The annual average temperature has increased by 1.2˚F across the continental United States during the years 1986 to present compared to the time period 1901 to 1960 and temperatures are expected to continue rising. *Figure 19 - Observed and Projected Temperature Change* for Pennsylvania *for Pennsylvania* shows these projected changes in temperature for Pennsylvania based on climate models considering the possibilities of increased and decreased levels of greenhouse gas emissions. In recent years, record high temperatures have outnumbered record low temperatures 2:1 so it is expected that the risk of extreme heat will be amplified whereas the risk of extreme cold will be attenuated. The Northeastern United States is expected to experience twenty to thirty more days with temperatures above 90˚F, and twenty to thirty fewer days below freezing by approximately 2050. While there may be fewer extreme cold events, those that do occur are expected to reach record-setting low temperatures more often. Historically, Monroe County has had more extreme cold events than extreme heat events due to the geographic location of the county; however, this balance is expected to shift somewhat in the coming years to include a greater proportion of extreme heat events.

Figure 19 - Observed and Projected Temperature Change for Pennsylvania



4.3.3.5 Vulnerability Assessment

Extreme temperatures are usually a regional hazard when they occur. The very old (17.8% of sixty-five years or older individuals in Monroe) and the very young (4.7% of five years of younger in Monroe) are most vulnerable to extreme temperatures due to risk factors, mobility challenges and disabilities. Extreme temperatures can increase the demand for utility services, often resulting in an increased cost to consumers. The increased expense can make it difficult for the consumer to afford the service. The increased demand for services may cause a decrease in availability of these services or failure of the system. A decrease or failure of the utility system during extreme temperature events puts a large population at great risk. Extreme temperature events can also drastically increase the volume of emergency calls, potentially overwhelming the public safety answering point. Extreme heat events can also contribute to drought conditions, which in turn increase the risk of wildfires.

4.3.4. Flood, Flash Flood, and Ice Jams

4.3.4.1 Location and Extent

Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often in mountain streams and mountainous regions, and in urban areas where much of the ground is covered by impervious surfaces. Flash floods are relatively common in Monroe County and the severity of said flood events is dependent upon a combination of creek, stream, and river basin topography and physiography, hydrology, precipitation, and weather patterns. Present soil conditions, the degree of vegetative clearing, and the presence of impervious cover must also be considered when determining the severity of a flood or flood event.

Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often then breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure.

Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood. Flood recurrence intervals are explained in more detail in Section 4.3.4.4. However, in assessing the potential spatial extent of flooding, it is important to know that a floodplain associated with a flood that has a 10% chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2% annual chance of occurring.

The National Flood Insurance Program (NFIP) publishes digital flood insurance rate maps (DFIRMs). These maps identify the 1% annual chance of flood area. Special flood hazard area (SFHA) and base flood elevations (BFE) are developed from the 1% annual chance flood event. As seen in *Figure 20 – Flooding and Floodplain Diagram*. Structures located within the SFHA have a 26% chance of flooding in a thirty-year period. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth of Pennsylvania, and Monroe County local governments. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to the following high-risk special flood hazard areas in *Table 14 – Flood Hazard High Risk Zones*. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Monroe County with vulnerable structures and functional needs facilities identified using the most current DFIRM data for Monroe County dated 2020.

Most of Monroe County's municipalities are flood prone. Flood problems exist mostly in Hamilton, Paradise, Pocono, Tobyhanna, and Tunkhannock Townships. Flooding has also occurred in multiple boroughs, including East Stroudsburg and Stroudsburg Boroughs. Flooding has occurred along the Delaware River and the Lehigh River and their tributaries that run through Monroe County.

Past flooding events have been primarily caused by heavy rains which cause small creeks and streams to overflow their banks, often leading to road closures. Flooding poses a threat to functional needs facilities, agricultural areas, and those who reside or conduct business in the floodplain. The most significant hazard exists for facilities in the floodplain that process, use and/or store hazardous materials. A flood could potentially release and transport hazardous materials out of these areas. As the water recedes it would spread the hazardous materials throughout the area. Most flood damage to property and structures located in the floodplain is caused by water exposure to the interior, high velocity water and debris flow.

Figure 20 - Flooding and Floodplain Diagram

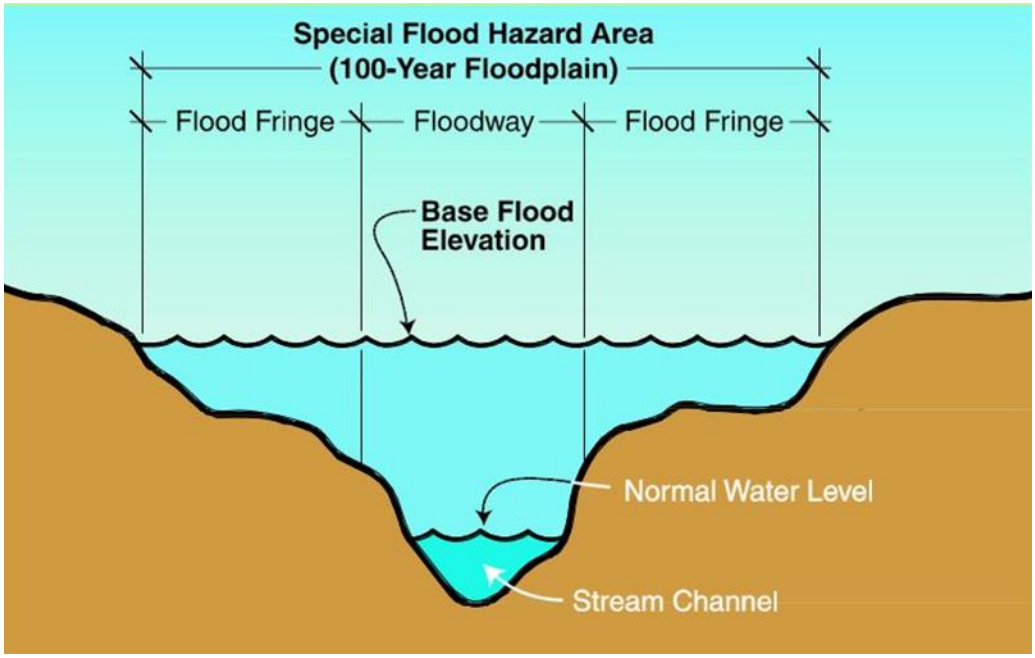


Table 14 - Flood Hazard High Risk Zones

Flood Hazard High Risk Zones *(FEMA, 2017)*	
Zone	**Description**
A	Areas subject to inundation by the 1% annual chance flood event. Because detailed hydraulic analysis has not been performed, no base flood elevations or flood depths are shown
AE	Areas subject to inundation by the 1% annual chance flood event determined by detailed methods. BFEs are shown within these zones.
AH	Areas subject to inundation by the 1% annual chance shallow flooding (usually areas of ponding) where average depths are 1-3 feet. BFEs derived from detailed hydraulic analysis are shown in this zone.
AO	Areas subject to inundation by the 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1-3 feet. Average flood depths derived from detailed hydraulic analysis are shown within this zone.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection.

4.3.4.2 Range of Magnitude

The Delaware River Basin and the Lehigh River Basin have caused significant flooding in Monroe County, specifically on the following rivers and their tributaries:

- Delaware River:
  - Caledonia Creek
  - Cherry Creek
- Lehigh River:
  - Tobyhanna Creek
  - Trout Creek

Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover and the rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. The mountainous terrain of Monroe County can cause more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain.

Urbanization typically results in the replacement of vegetative ground cover with impermeable surfaces like asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems. A large amount of rainfall over a short time span can cause flash floods. Additionally, small amounts of rain can cause floods in locations where the soil is still frozen, saturated from a previous wet period, or if the area is largely covered in impermeable surfaces such as parking lots, paved roadways, and other developed areas. The county occasionally experiences intense rainfall from a tropical storm in late summer and early fall, which can potentially cause flooding as well.

Severe flooding can cause injuries and deaths and can have long-term impacts on the health and safety of the citizens. Severe flooding can also result in significant property damage, potentially disrupting the regular function of functional needs facilities and have long-term negative impacts on local economies. Industrial, commercial, and public infrastructure facilities can become inundated with flood waters, threatening the continuity of government and business. The functional needs population must be identified and located in flooding situations, as they are often home bound. Mobile homes are especially vulnerable to high water levels. Flooding can have significant environmental impacts when flood water release and/or transport hazardous materials.

Flash floods can occur very quickly and with little warning. Flash floods can also be deadly because of the rapid rises in water levels and devastating flow velocities. The more developed areas in the county can be easily susceptible to flash floods because of the significant presence of impervious surfaces, such as streets, sidewalks, parking lots, and driveways.

Severe flooding also comes with many secondary effects that could have long lasting impacts on the population, economy, and infrastructure of Monroe County. Power failures are the most common secondary effect associated with flooding. Coupled with a shortage of critical services and supplies, power failures could cause a public health emergency. Critical infrastructure, such as sewage and water treatment facilities, can fail, causing sewage overflows and the contaminating of groundwater and drinking water. Flooding also has the potential to trigger other hazards, such as landslides, hazardous material spills, and dam failures.

The maximum threat of flooding for Monroe County is estimated by looking at the potential loss data and repetitive loss data, both analyzed in the risk assessment portion of the hazard mitigation plan. In these cases, the severity and frequency of damage can result in permanent population displacement, and businesses may close if they are unable to recover from the disaster.

Estimation of potential loss is completed through FEMA's HAZUS software. A level two HAZUS scenario was performed for the entirety of Monroe County and there were no failed reaches within the scenario. Monroe County has a large portion of streams and rivers that can lead to flood inundation. The FEMA reports generated by the software at the end of the scenario were utilized to estimate the amount of damage and loss from a flood. The total building loss for a 100-year flood based on a HAZUS level two scenario is displayed in *Table 15 – HAZUS Building Economic Loss Figures*. The total business interruption values occurring from a proposed 100-year flood based on FEMA HAZUS data is illustrated in *Table 16 – HAZUS Business Interruption Economic Loss Figures*. *Figure 21 – Loss by Occupancy Type* illustrates the breakdown of economic loss by either residential, commercial, industrial, or other.

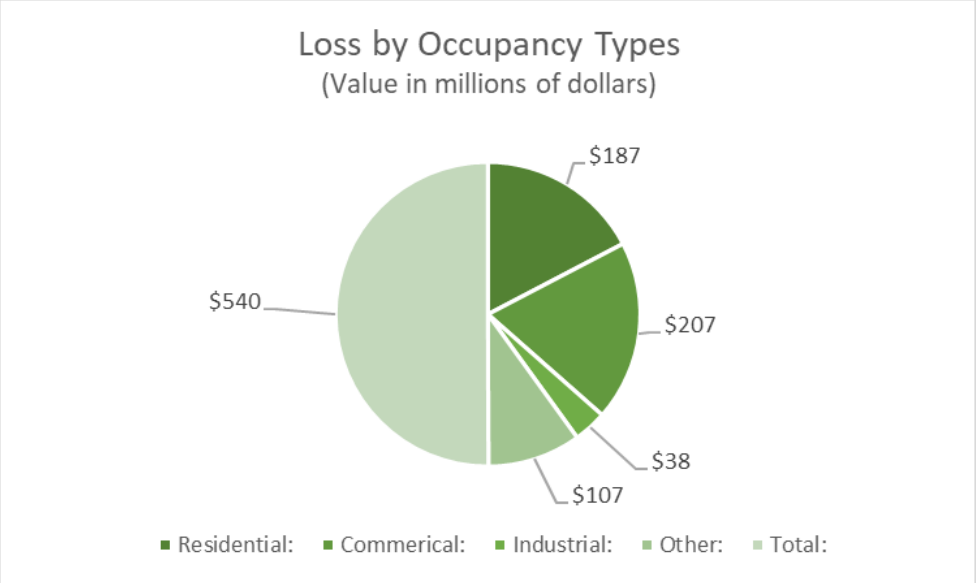
Table 15 - HAZUS Building Economic Loss Figures

HAZUS Building Economic Loss Figures (HAZUS 2021)					
	Residential	**Commercial**	**Industrial**	**Other**	**Total**
Building:	$91,510,000	$21,760,000	$9,420,000	$2,930,000	**$125,630,000**
Content:	$52,340,000	$67,760,000	$23,380,000	$14,540,000	**$158,020,000**
Inventory:	$0	$1,280,000	$3,570,000	$60,000	**$4,910,000**
Subtotal:	***$143,850,000***	***$90,810,000***	***$36,370,000***	***$17,540,000***	***$288,560,000***

Table 16 - HAZUS Business Interruption Economic Loss Figures

HAZUS Business Interruption Economic Loss Figures (HAZUS 2021)					
	Residential	**Commercial**	**Industrial**	**Other**	**Total**
Income:	$1,960,000	$42,260,000	$460,000	$3,870,000	**$48,540,000**
Relocation:	$24,060,000	$12,660,000	$570,000	$2,120,000	**$39,410,000**
Rental Income:	$12,820,000	$9,450,000	$130,000	$200,000	**$22,600,000**
Wage:	$4,620,000	$51,950,000	$810,000	$83,490,000	**$140,870,000**
Subtotal:	**$43,460,000**	**$116,320,000**	**$1,960,000**	**$89,690,000**	**$251,420,000**

Figure 21 - Loss by Occupancy Type



Although floods can cause deaths, injuries, and damage to property, they are naturally occurring events that benefit riparian systems which have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient rich sediment which improves soil fertility. However, human development often disrupts natural riparian buffers by charging land use and land cover, and the introduction of chemical or biological contaminants that often accompany human presence can contaminate habitats after flood events.

4.3.4.3 Past Occurrence

Monroe County has experienced numerous flooding, flash flooding, and ice jam events in the past. The flooding and flash flooding were caused by a variety of heavy storms, tropical storms, and other issues. A summary of flood event history for Monroe County from January 1996 to

March 2021 is found in *Table 17 – Past Flood and Flash Flood Events*. Details of each event can be found in NOAA's National Center for Environmental Information (NCEI) database.

Table 17 - Past Flood and Flash Flood Events

Past Flood and Flash Flood Events (NCEI NOAA)			
Event Location	**Event Date**	**Event Type**	**Property Damage Estimate**
Monroe County (entire county)	01/19/1996	Flood	$25,000,000.00*
Monroe County (entire county)	01/19/1996	Flash Flood	$0*
Monroe County (entire county)	01/27/1996	Flash Flood	$0*
Monroe County (entire county)	04/16/1996	Flash Flood	$0*
Monroe County (southern portion)	06/22/1996	Flash Flood	$0*
Monroe County (entire county)	10/19/1996	Flash Flood	$0*
Monroe County (entire county)	11/08/1996	Flash Flood	$0*
Monroe County (entire county)	12/02/1996	Flash Flood	$0*
Monroe County (southeastern portion)	09/09/1999	Flash Flood	$0*
Monroe County (entire county)	09/16/1999	Flash Flood	$0*
Monroe County (entire county)	12/17/2000	Flash Flood	$0*
Monroe County (southeastern portion)	07/25/2001	Flash Flood	$0*
Monroe County (northern portion)	05/28/2002	Flash Flood	$0*
Monroe County (northern portion)	06/26/2002	Flash Flood	$0*
Monroe County (northwestern portion)	07/23/2002	Flash Flood	$0*

Event Location	Event Date	Event Type	Property Damage Estimate
Monroe County (southern portion)	06/12/2003	Flash Flood	$0*
Monroe County (entire county)	06/21/2003	Flood	$0*
Monroe County (entire county)	08/16/2003	Flash Flood	$0*
Monroe County (entire county)	09/23/2003	Flood	$0*
Monroe County (entire county)	12/11/2003	Flood	$0*
Monroe County (central portion)	08/12/2004	Flood	$0*
Monroe County (entire county)	09/18/2004	Flood	$8,000,000.00*
Monroe County (entire county)	01/14/2005	Flood	$0*
Monroe County (entire county)	04/02/2005	Flood	$40,000,000.00*
Monroe County (entire county)	10/08/2005	Flood	$0*
Monroe County (entire county)	01/18/2006	Flood	$0*
Monroe County (entire county)	06/27/2006	Flood	$16,000,000.00*
Monroe County (entire county)	06/27/2006	Flash Flood	$0*
Tobyhanna Township	04/15/2007	Flood	$0*
East Stroudsburg Borough	06/01/2007	Flash Flood	$0*
Middle Smithfield Township	06/14/2008	Flash Flood	$0*
Hamilton Township	06/14/2008	Flash Flood	$0*
Hamilton Township	08/15/2008	Flash Flood	$0*
Pocono Township	07/29/2009	Flash Flood	$0*
Hamilton Township	07/29/2009	Flash Flood	$0*

Event Location	Event Date	Event Type	Property Damage Estimate
Tobyhanna Township	09/30/2010	Flood	$0*
Tunkhannock Township	10/01/2010	Flood	$0*
Smithfield Township	03/07/2011	Flood	$0*
Smithfield Township	03/10/2011	Flood	$0*
Stroud Township	05/19/2011	Flash Flood	$0*
Smithfield Township	08/28/2011	Flood	$175,000.00*
Tobyhanna Township	08/28/2011	Flash Flood	$0*
East Stroudsburg Borough	09/07/2011	Flood	$0*
Stroudsburg Borough	09/08/2011	Flood	$0*
Ross Township	09/28/2011	Flash Flood	$0*
East Stroudsburg Borough	05/26/2012	Flash Flood	$0*
Hamilton Township	05/26/2012	Flash Flood	$25,000.00*
Pocono Township	05/26/2012	Flash Flood	$0*
Chestnuthill Township	09/04/2012	Flash Flood	$0*
Stroudsburg Borough	09/04/2012	Flash Flood	$0*
Tobyhanna Township	09/18/2012	Flash Flood	$0*
Hamilton Township	07/01/2013	Flash Flood	$0*
Tobyhanna Township	07/02/2013	Flood	$0*
Middle Smithfield Township	07/28/2013	Flash Flood	$0*
Chestnuthill Township	08/09/2013	Flash Flood	$0*
Stroudsburg Borough	01/11/2014	Flood	$0*
Hamilton Township	06/14/2015	Flood	$0*
Paradise Township	06/30/2015	Flash Flood	$0*
Pocono Township	06/30/2015	Flash Flood	$100,000.00*
Paradise Township	07/01/2015	Flash Flood	$0*
Stroudsburg Borough	07/06/2019	Flash Flood	$0*
East Stroudsburg Borough	07/31/2019	Flash Flood	$0*
Jackson Township	08/06/2019	Flash Flood	$0*
Stroudsburg Borough	10/31/2019	Flash Flood	$0*
Chestnuthill Township	10/31/2019	Flash Flood	$0*
Hamilton Township	08/04/2020	Flash Flood	$0*
*Property Damage Values are estimated and are not an exact figure. Data from NCEI.			

The National Flood Insurance Program (NFIP) identifies properties that frequently experience flooding. Repetitive loss properties are structures insured under the NFIP which have had at least two paid flood losses of more than $1,000 over any ten-year period since 1978. The hazard mitigation assistance (HMA) definition of a repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that has incurred flood-related damage on two occasions, in which the cost of repair, on average, equaled or exceeded 25% of the market value of the structure at the time of each such flood event; and at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage. *Table 18 – Repetitive Loss Properties* and *Table 19 – Summary of Type of Repetitive Loss Properties by Municipality* illustrates the communities that have repetitive loss properties, the total building payments, the content payments, and the number of losses and properties.

A property is considered a severe repetitive loss property either when there are at least four losses each exceeding $5,000 or when there are two or more losses where the building payments exceed the property value. There are forty repetitive loss properties in Monroe County. *Table 20 – Severe Repetitive Loss Properties* illustrates the communities within Monroe County that have severe repetitive loss properties, the total building payments, the contents payments and the number of losses and properties. The data used in the table is based on data from PEMA.

Most municipalities in Monroe County participate in the NFIP. Information on each participating municipality can be found in *Table 21 – Municipal NFIP Policies & Vulnerability*.

Table 18 - Repetitive Loss Properties

Repetitive Loss Properties (PEMA)						
Community Name	**Community Number**	**Cumulative Building Payment**	**Cumulative Contents Payment**	**Sum of Total Paid**	**Losses**	**NFIP Policies** as of February 10, 2021
Barrett Township	421884	$4,213.79	$743.90	$4,957.69	2	1
Chestnuthill Township	421885	$76,015.35	$0.00	$76,015.35	7	2
Delaware Water Gap Borough	420690	$1,121,425.58	$1,131,749.59	$2,253,175.17	6	2
Eldred Township	421887	$17,462.60	$11,903.04	$29,365.64	3	1
Hamilton Township	421888	$289,667.67	$14,160.84	$303,828.51	10	3

Community Name	Community Number	Cumulative Building Payment	Cumulative Contents Payment	Sum of Total Paid	Losses	NFIP Policies as of February 10, 2021
Middle Smithfield Township	421890	$34,149.12	$0.00	$34,149.12	3	1
Ross Township	421895	$20,254.77	$0.00	$20,254.77	2	1
Smithfield Township	421896	$4,821,336.99	$1,055,790.69	$5,877,127.68	64	21
Stroud Township	420693	$95,102.28	$95,075.98	$190,178.26	14	6
Stroudsburg Borough	420694	$8,328.87	$0.00	$8,328.87	3	1
Tobyhanna Township	421897	$25,005.07	$1,173.93	$26,179.00	2	1
	Total:	**$6,512,962.09**	**$2,310,597.97**	**$9,167,391.33**	**116**	**40**

Table 19 - Summary of Type of Repetitive Loss Properties by Municipality

Summary of Type of Repetitive Loss Properties by Municipality					
Municipality	Type				
	Non-Residential	2-4 Family	Single Family	Condo	Other Residential
Barrett Township	0	0	1	0	0
Chestnuthill Township	1	0	1	0	0
Delaware Water Gap Borough	1	1	0	0	0
Eldred Township	0	0	1	0	0
Hamilton Township	0	1	2	0	0
Middle Smithfield Township	0	0	1	0	0
Ross Township	0	0	1	0	0
Smithfield Township	4	0	16	1	0
Stroud Township	3	0	1	2	0
Stroudsburg Borough	0	0	1	0	0
Tobyhanna Township	0	0	1	0	0

Table 20 - Severe Repetitive Loss Properties

Severe Repetitive Loss Properties (PEMA)						
Community Name	**Community Number**	**Cumulative Building Payments**	**Cumulative Contents Payment**	**Sum of Total Paid**	**Losses**	**Properties**
Smithfield Township	421896	$178,562.18	$58,672.53	$237,234.71	8	2

Table 21 - Municipal NFIP Policies & Vulnerability

Municipal NFIP Policies (PEMA 2019)					
Community Name	**Comm. Num.**	**Contract Count**	**Policy Count**	**Total Coverage**	**Premium and Policy Fee**
Barrett Township	421884	15	15	$3,404,500.00	$20,830.00
Chestnuthill Township	421885	35	35	$8,678,900.00	$62,777.00
Coolbaugh Township	421886	72	72	$13,535,400.00	$68,349.00
Delaware Water Gap Borough	420690	7	7	$1,356,400.00	$8,997.00
East Stroudsburg Borough	420691	11	11	$3,664,800.00	$47,759.00
Eldred Township	421887	10	10	$1,797,300.00	$8,223.00
Hamilton Township	421888	32	32	$9,697,500.00	$50,831.00
Jackson Township	421889	5	5	$1,197,000.00	$1,871.00
Middle Smithfield Township	421890	34	34	$8,981,500.00	$23,555.00
Mount Pocono Borough	420692	3	3	$840,000.00	$1,204.00
Paradise Township	421891	13	13	$10,600,000.00	$17,805.00
Pocono Township	421892	29	29	$7,000,600.00	$53,957.00
Polk Township	421893	27	27	$4,197,300.00	$26,127.00
Price Township	421894	3	3	$1,050,000.00	$1,241.00
Ross Township	421895	12	12	$1,754,700.00	$7,522.00
Smithfield Township	421896	52	52	$15,643,600.00	$131,859.00

Community Name	Comm. Num.	Contract Count	Policy Count	Total Coverage	Premium and Policy Fee
Stroud Township	420693	63	63	$18,395,700.00	$63,749.00
Stroudsburg Borough	420694	24	24	$8,681,000.00	$40,755.00
Tobyhanna Township	421897	43	43	$11,831,600.00	$28,873.00
	Total:	**490**	**490**	**$132,307,800.00**	**$666,284.00**

4.3.4.4 Future Occurrence

Flooding is a frequent problem throughout the Commonwealth of Pennsylvania. Monroe county will certainly be impacted by the flooding events in the future, as Monroe County experiences some degree of flooding annually. The threat of flooding is compounded in the late winter and early spring months, as melting snow can overflow streams, creeks, and tributaries, increasing the amount of groundwater, clogging stormwater culverts and bridge openings. The NFIP recognizes the 1% annual chance flood, also known as the base flood or one-hundred-year flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1% annual chance flood is a flood which has a 1% chance of occurring in a given year or is likely once every one-hundred-years. The digital flood insurance maps (DFIRMs) are used to identify areas subject to the 1% annual chance of flooding. A property's vulnerability to a flood is dependent upon its location in the floodplain. Properties along the banks of a waterway are the most vulnerable. The property within the floodplain is broken into sections depending on its distance from the waterway. The ten-year flood zone that has a 10% chance of being flooded every year. However, this label does not mean that this area cannot flood more than once every ten years. This label simply designates the probability of a flood of this magnitude every year. Further away from this area is the fifty-year floodplain. This area includes all of the ten-year floodplain plus additional property. The probability of a flood of this magnitude occurring during a one-year period is 2%. A summary of flood probability is show in *Table 22 – Flood Probability Summary.*

Table 22 - Flood Probability Summary

Flood Probability Summary *(FEMA)*	
Flood Recurrence Intervals	**Annual Chance of Occurrence**
10-year	10.00%
50-year	2.00%
100-year	1.00%

Flood Recurrence Intervals	Annual Chance of Occurrence
500-year	0.20%

4.3.4.5 Vulnerability Assessment

River and Stream Flooding:

Monroe County is vulnerable to stream and river flooding events, as shown in *Figure 22 – A Flooded Stream Flows Under a Monroe County Bridge*. Flooding puts the entire population at some level of risk, whether through flooding of homes, businesses, places of employment, roadways, sewer, and water infrastructure. Flooding can cause significant power outages and poor road conditions that can lead to heightened transportation accident risk.

Functional needs facilities and critical infrastructure are the most vulnerable buildings and services when river and stream flooding is considered. Functional needs facilities are facilities that if damaged would present an immediate threat to life, public health, and safety. Facilities that use and store hazardous materials pose a potential threat to the environment during flooding events if flooding causes a leak, inundation, or equipment failure. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Monroe County, with vulnerable structures and functional needs facilities that are located within the special flood hazard area.

Figure 22 - A Flooded Stream Flows Under a Monroe County Bridge

Image Provided by Monroe County OEM.

While the regulatory one-hundred-year floodplain is defined by the NFIP and FEMA is a useful tool to estimate flooding vulnerability, it is important to note that it is not always completely accurate.

Flash Flooding:

Flash flooding is a common occurrence in Monroe County and can occur anywhere in the county. A large portion of flash flooding occurs in populated areas that have increased impervious ground cover. During the risk assessment process, numerous resources were utilized to determine flash flooding locations in Monroe County. Municipalities were asked to identify locations within the municipality that were prone to frequent flash flooding. The National Climatic Data Center was also queried to determine flash flood vulnerable areas. This data reflected in *Table 17 – Past Flood and Flash Flood Events* above.

Locations that are identified as vulnerable to flash flooding in Monroe County are as follows:

- Stroudsburg Borough
- East Stroudsburg Borough
- Chestnuthill Township
- Hamilton Township
- Tobyhanna Township
- Tunkhannock Township

Although the above locations were identified as vulnerable areas in Monroe County, they are not the only locations that are vulnerable to flash flooding. The Monroe County Hazard Mitigation Team will continue to work with municipalities to identify vulnerable flash flooding locations and identify vulnerable functional needs populations and critical facilities.

Ice Jam Flooding:

Ice jam flooding has affected Monroe County in the past, as seen in *Figure 23 – An Ice Jam Formation Along a Riverbank*. Areas along the Delaware River and Lehigh River are the most vulnerable. The affected areas would see an increase in erosion to riverbanks and loss of vulnerable land.

The Monroe County Hazard Mitigation Team will continue to work with municipalities to identify vulnerable ice jam flooding locations and identify vulnerable functional needs population and facilities.

Figure 23 - An Ice Jam Formation Along a Riverbank

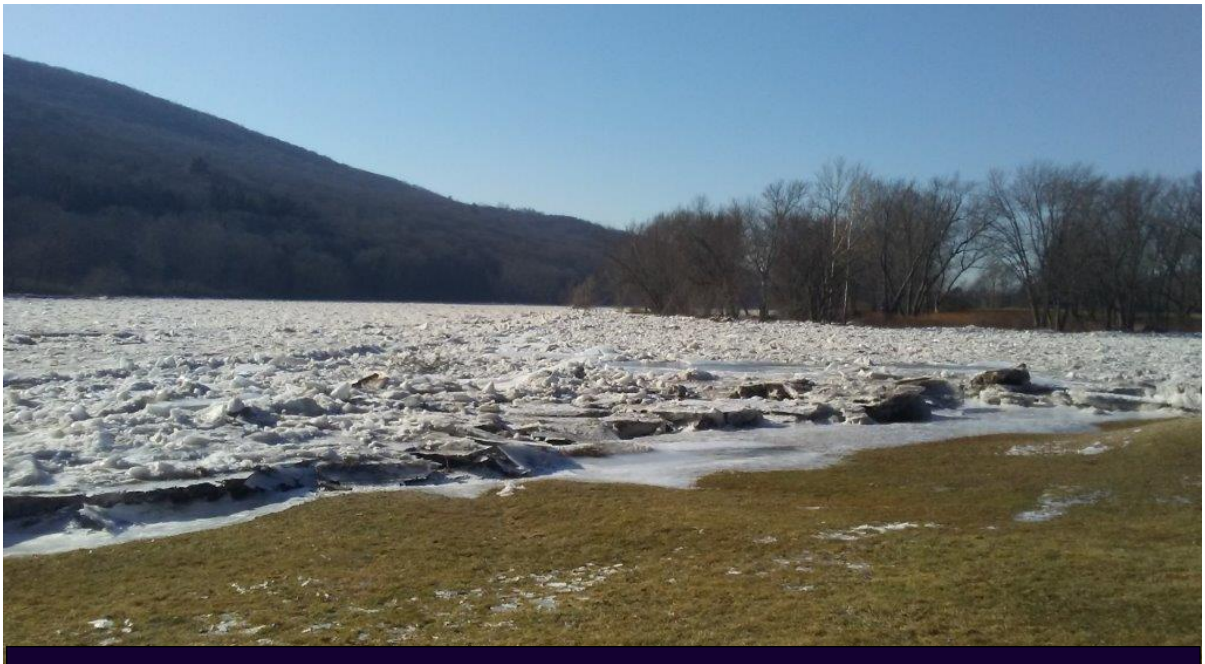


Image Provided by Monroe County OEM.

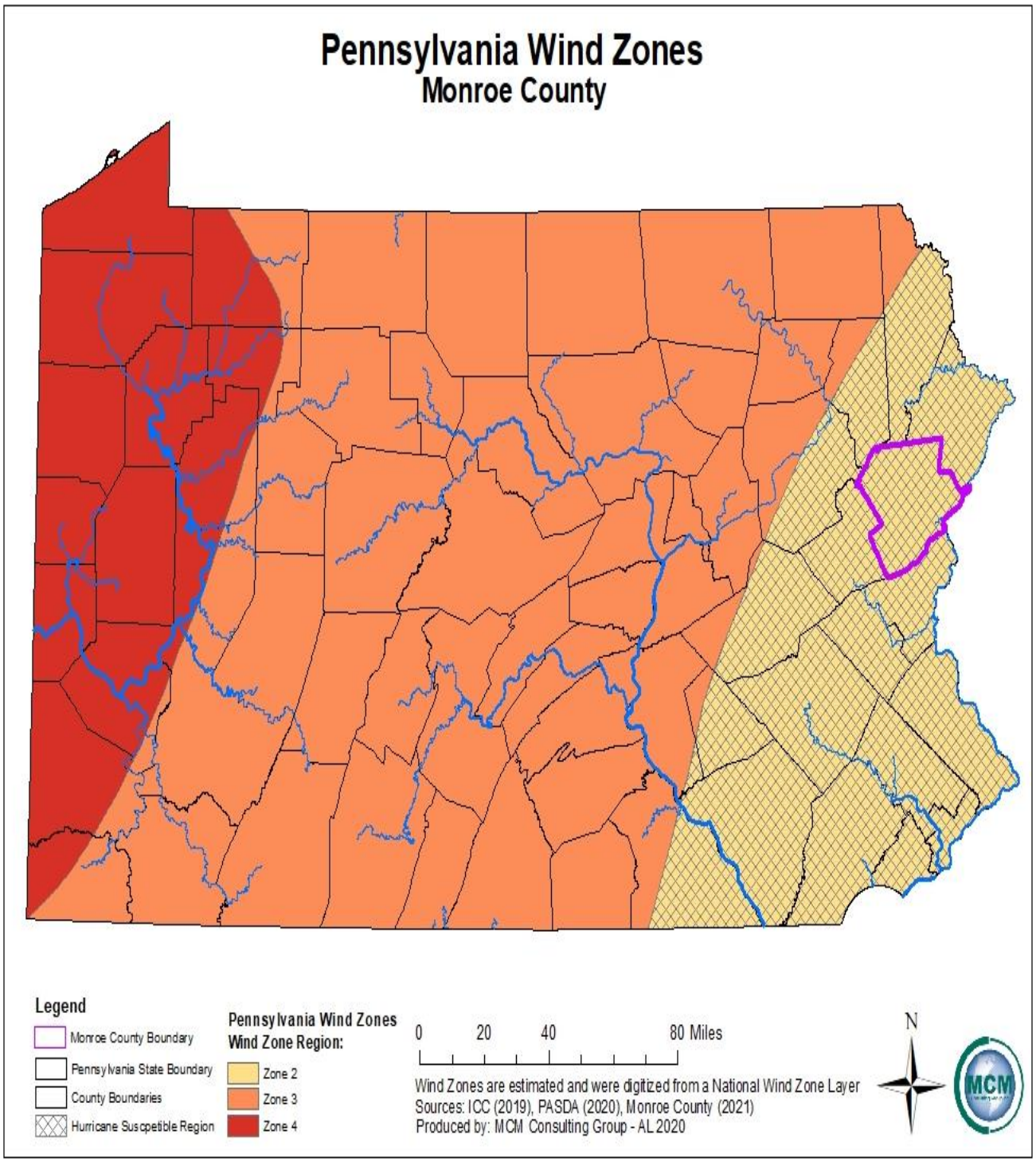
4.3.5. Hurricane, Tropical Storm

4.3.5.1 Location and Extent

Monroe County does not have any open-ocean coastline areas. However, the impacts from coastal storms such as tropical storms and hurricanes can expand inland. Tropical depressions are cyclones with maximum sustained winds of less than 39 miles per hour (mph). The system becomes a tropical storm when the maximum sustained winds reach between 39 – 74 mph. When wind speeds exceed 74 mph, the system is considered a hurricane. Tropical storms impacting Monroe County develop in tropical or sub-tropical waters found in the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico. Another type of tropical storms are nor'easters, which are large cyclones that rotate counterclockwise and are typically associated with the Atlantic Ocean and the East Coast of the United States between North Carolina and Massachusetts. The name nor'easter comes from the direction that the strongest winds typically blow from the cyclone.

While Monroe County is located about 75 miles inland of the East Coast of the United States, tropical storms can track inland and cause heavy rainfall and strong winds. Monroe County is located just inland of the East Coast region, designated by FEMA, as being Hurricane-Susceptible (see *Figure 24 – Pennsylvania Wind Zones*). Monroe County falls within the wind zone II as shown in *Figure 24 – Pennsylvania Wind Zones*. Zone II for Monroe suggests that shelters and critical facilities should be able to withstand a three second gust of wind up to 160 mph. Tropical storms and hurricanes are regional and seasonal events that can impact very large areas that are hundreds to thousands of miles across over the life of the storm. Hurricane and tropical storm season are typically around June to November time. All communities within Monroe County are equally subject to the impacts of hurricanes and tropical storms that track near the county. Areas in Monroe County which are subject to flooding, wind, and winter storm damage are particularly vulnerable.

Figure 24 - Pennsylvania Wind Zones



4.3.5.2 Range of Magnitude

Table 23 - Saffir-Simpson Hurricane Scale

Saffir-Simpson Hurricane Scale		
Category	Wind Speed	
	mph	knots
5	≥156	≥135
4	131-155	114-134
3	111-130	96-113
2	96-110	84-95
1	74-95	65-83
Non-Hurricane Classifications		
Tropical Storm	39-73	34-64
Tropical Depression	0-38	0-33

The impact tropical storm or hurricane events have on an area is typically measured in terms of wind speed. Flood damage results from intense precipitation and wind, typically from coastal storms, which impact Monroe County. Expected damage from hurricane force winds is measured using the Saffir-Simpson Scale (*Table 23 – Saffir Simpson Scale*). The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. Categories three, four, and five are classified as "major" hurricanes, but category one and two storms can contain potential significant storm surge. A category one storm results in very dangerous winds with some damage, while a category two storm results in extremely dangerous winds with extensive damage. However, category three storms result in devastating damage and category four/five storms result in catastrophic damage. While major hurricanes comprise only 20% of all tropical cyclones making landfall, they account for over 70% of the damage in the United States. While hurricanes can cause high winds and associated impacts, it is also important to recognize the potential for flooding events during hurricanes, tropical storms, and nor'easters. In Monroe County, wind impacts from tropical events include downed trees and utility poles to cause utility interruptions. Wind impacts are an additional issue associated with mobile homes due to structures not being well-anchored. Additionally, these storms can produce high volumes of rainfall in Monroe County that cause flash flooding initially and then follow with stream and river flooding. The risk assessment and associated impact for flooding events is included Section 4.3.4.5.

4.3.5.3 Past Occurrence

Table 24 - History of Coastal Storms Impacting Monroe County Impacting Monroe County lists all coastal storms that have impacted Monroe County from 1952 to 2020. *Figure 27 – Historic Tropical Storms/Hurricanes in Pennsylvania* identifies some past hurricanes that had an inland path through Pennsylvania. Hurricane Agnes was a severe coastal storm event in June 1972 that

impacted Monroe County. After making first landfall as a hurricane near Florida, Agnes weakened and exited back into the Atlantic off the North Carolina coast. The storm moved along the coast and made a second landfall near New York City as a tropical storm and merged with an extra-tropical low-pressure system over Pennsylvania. This brought extremely heavy rains to Pennsylvania that caused major flooding throughout. Pennsylvania incurred $2.8 billion in damages and fifty deaths statewide. However, particularly in Monroe County, the most significant effects of Hurricane Agnes were due to severe flooding rather than winds. Agnes was only a Category 1 hurricane but dropped more than fifteen inches of rain in the northeastern United States. Pennsylvania received the greatest amount of flood damage.

Hurricane Irene and Tropical Storm Lee were another event that caused impact and damage to Monroe County. Although they are separate events, Hurricane Irene and Tropical Storm Lee together caused significant rainfall to occur in Monroe County due to how close together the events took place. First, Tropical Storm Lee hit and caused significant flooding in the central and eastern counties of Pennsylvania with wind damage that caused utility outages for one to two days in Monroe County. Then, Hurricane Irene caused flooding with utility interruptions from five to eight days. At the end of August, together these storms had a total of 8.6 to 12.8 inches of rainfall in Monroe County. The total rainfall in Monroe County was greater than 75% above the typical rainfall average in the county. Many flooding events took place in the county during this time.

Hurricane Sandy is another coastal storm event that caused significant damage to Monroe County. Sandy caused significant wind damage and utility interruptions for eight to ten days. More specifically, the Poconos was the most hit area in Monroe County. Hurricane Sandy ranks among the most damaging coastal storms to ever hit the Poconos and Monroe County. In Monroe County, more than 70,000 people, or more than 41% of the county's population, were without power for an extended period of time. Monroe County had assessed 200 structures, including mobile and single-family homes/businesses, for property damage. The estimated storm-recovery costs total is between $70 to $80 million which includes all labor, housing, materials/equipment, and feeding expanded 24/7 staffing for longer than a week. *Figure 25 – Fallen Trees are Cleared from Powerlines Following Superstorm Sandy* and *Figure 26 – Uprooted Trees Lay Atop Crushed House* and exemplify the damage such storms can inflict.

Figure 25 - Fallen Trees are Cleared from Powerlines Following Superstorm Sandy

Image Provided by Monroe County OEM.

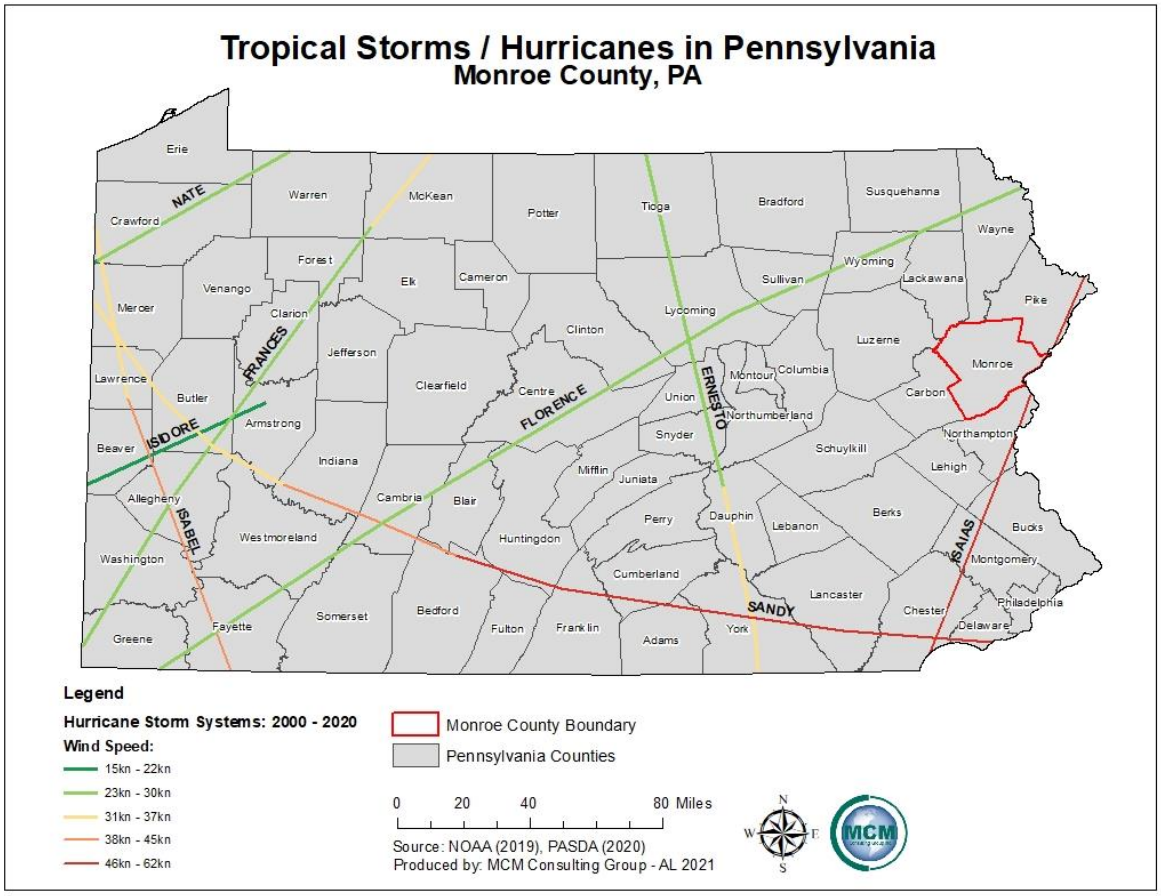
Figure 26 - Uprooted Trees Lay Atop Crushed House

Image Provided by Monroe County OEM.

Table 24 - History of Coastal Storms Impacting Monroe County

History of Coastal Storms Impacting Monroe County (HomeFacts, 2018; USGS, 2020)			
Year	**Name**	**Year**	**Name of Costal Storm**
1952	Able	2005	Katrina
1954	Hazel	2006	Ernesto
1955	Diane	2011	Lee
1955	Connie	2011	Irene
1959	Gracie	2012	Sandy
1972	Agnes	2016	Matthew
1979	David	2017	Harvey
1992	Danielle	2017	Irma
1994	Beryl	2017	Nate
1999	Dennis	2018	Florence
1999	Floyd	2020	Isaias
2004	Ivan		

Figure 27 - Historic Tropical Storms/Hurricanes in Pennsylvania



4.3.5.4 Future Occurrence

Although hurricanes and tropical storms can cause flood events consistent with 100- and 500-year flood levels, the probability of occurrence of hurricanes and tropical storms is measured relative to wind speed. *Table 25 – Annual Probability of Wind Speeds* shows the annual probability of winds that reach the strength of tropical storms and hurricanes in Monroe County and the surrounding areas based on a sample period of forty-six years. According to FEMA, there is a high probability each year that Monroe County will experience winds from coastal storms that could cause minimal to moderate damages (*Table 25 – Annual Probability of Wind Speeds*). The future probability of a tropical storm or hurricane will be approximately once every five years, or 20% chance annually. The probability of winds exceeding 118 mph is less than 0.1% annually.

Table 25 - Annual Probability of Wind Speeds

Annual Probability of Wind Speeds (FEMA, 2000)		
Wind Speed (mph)	**Saffir-Simpson Scale**	**Annual Probability of Occurrence (%)**
45-77	Tropical Storms// Category 1 Hurricane	91.59
78-118	Category 1 to 2 Hurricanes	8.32
119-138	Category 3 to 4 Hurricanes	.0766
139-163	Category 4 to 5 Hurricanes	.0086
164-194	Category 5 Hurricanes	.00054
195+	Category 5 Hurricanes	.00001

Climate change is causing atmospheric temperatures to rise, which corresponds to a rise in ocean surface temperatures, resulting in warmer and moister conditions where tropical storms develop. However, the relationship between climate change and hurricanes can be complex due to the many other factors that are associated with hurricane development which include wind shear and air pollution. Warmer oceans store more energy and are capable of fueling stronger storms and it is projected that Atlantic hurricanes will become more intense and produce more precipitation as ocean surface temperatures rise. The storms associated with the tropical storms/hurricanes can also linger for a longer period of time in a given place due to climate change which enhances destructive impacts in the future. Other possible connections of hurricanes in the near future related to climate change are the length of hurricane season and the increased frequency of the hurricanes earlier or later than usual hurricane season. There are expected to be more category four and five hurricanes in the Atlantic and the hurricane season may be elongated which may impact the future of Monroe County.

4.3.5.5 Vulnerability Assessment

The impacts of climate change are no longer hypothetical concepts set in the future, but rather tangible and hazardous realities. Tropical storms tracking nearby Monroe County can not only cause high winds but can also cause heavy rains to occur. A vulnerability assessment for hurricanes and tropical storms focusses on the impacts of flooding and severe winds. Flooding associated from hurricanes/tropical storms can occur in areas throughout Monroe County which can cause great loss and damage to buildings and structures as well. A vulnerability assessment for hurricanes and tropical storms focuses on the impacts of flooding and severe wind. The assessment for flood-related vulnerability is addressed in Section 4.3.4.5 and discussion of wind related vulnerability is addressed in Section 4.3.8.5. Due to the impact of the devastating hurricanes and tropical storms, the vulnerability for Monroe County is high. Two kinds of vulnerable economic losses were determined: direct building losses and business interruption

losses. Direct building losses consist of direct damage to any structure. Business interruption losses consist of relocation of employee wage loss, expenses, income loss, etc. Monroe County is highly vulnerable when it comes to the loss of buildings and other related items. The total direct building loss amount for Monroe County adds up to $161,204.00 in total damage due to wind hazards from hurricanes. The total business interruption for Monroe County adds up to $3.6 billion in total loss due to wind hazards from hurricanes. Therefore, building and business interruption losses in Monroe County are highly likely.

4.3.6. Invasive Species

4.3.6.1 Location and Extent

An invasive species is a species that is not indigenous to a given ecosystem and that, when introduced to a non-native environment, tends to thrive. The spread of an invasive species often alters ecosystems, which can cause environmental and economic harm and pose a threat to human health. The environment, the economy, and even human health can be impacted by an invasive species. Often, an invasive species spreads and reproduces quickly. They are not limited to organisms that come from a foreign country; invasive species can come from a different region in the United States. However, the main occurrence of invasive species is due to human activity. Either intentionally or unintentionally, other species may accompany people when they travel, introducing the stowaway species to a novel ecosystem. In a foreign ecosystem, a transported species may thrive, potentially restructuring the ecosystem and threatening its health. Common pathways for invasive species introduction to Pennsylvania include but are not limited to:

- Contamination of internationally traded products
- Hull fouling
- Ship ballast water release
- Discarded live fish bait
- Intentional release
- Escape from cultivation
- Movement of soil, compost, wood, vehicles or other materials and equipment
- Unregulated sale of organisms
- Smuggling activities
- Hobby trading or specimen trading

The Governor's Invasive Species Council of Pennsylvania (PISC), the lead organization for invasive species threats, recognizes two types of invasive species: Aquatic and Terrestrial.

Aquatic Invasive Species (AIS) are nonnative invertebrates, fishes, aquatic plants, and microbes that threaten the diversity or abundance of native species, the ecological stability of the infested

waters, human health and safety, or commercial, agriculture, or recreational activities dependent on such waters.

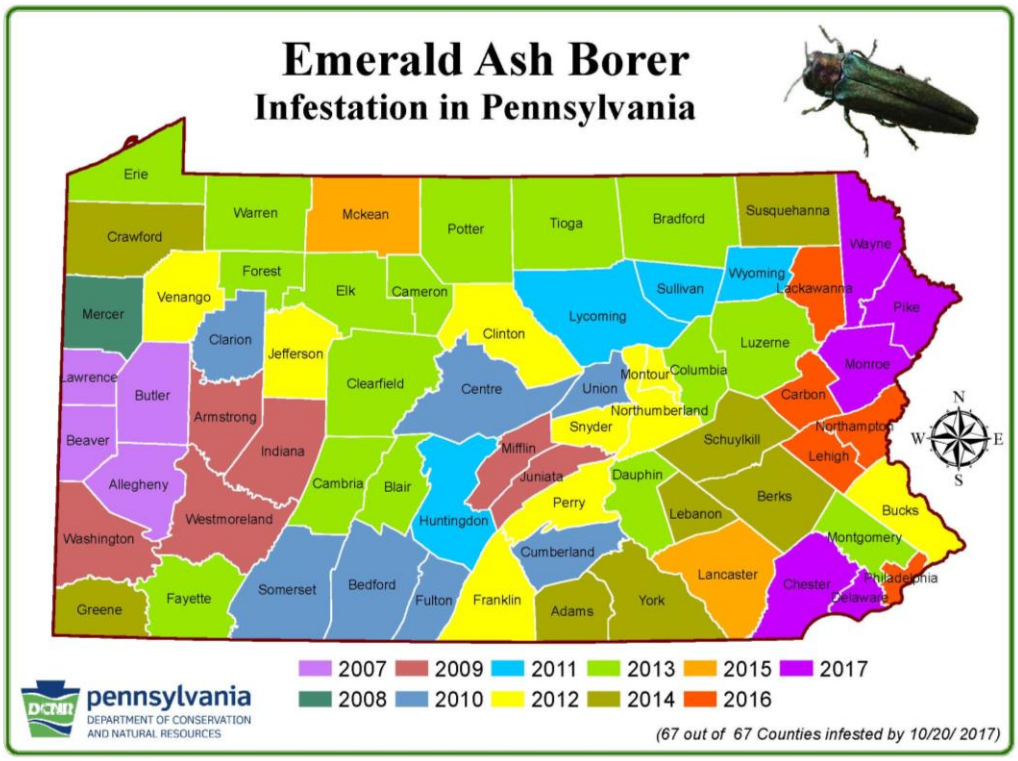
Terrestrial Invasive Species (TIS) are nonnative plants, vertebrates, arthropods, or pathogens that complete their lifecycle on land instead of in an aquatic environment and whose introduction does or is likely to cause economic/environmental damage or harm to human health.

The location and extent of invasive threats is dependent on the preferred habitat of the species, as well as the species' ease of movement and establishment. For example, kudzu vine is an aggressive vascular plant. With wide ecological parameters and ease of spread, the vine is a more widespread invasive species threat. Other species' spread has been limited by state agency activity, like the spotted lanternfly. First discovered in Berks County in 2014, this Asian plant hopper was placed under a quarantine by the Pennsylvania Department of Agriculture in thirteen counties, which later had an effect on Monroe County. *Table 26 - Prevalent Invasive Species* lists invasive species that have been found in Monroe County.

4.3.6.2 Range of Magnitude

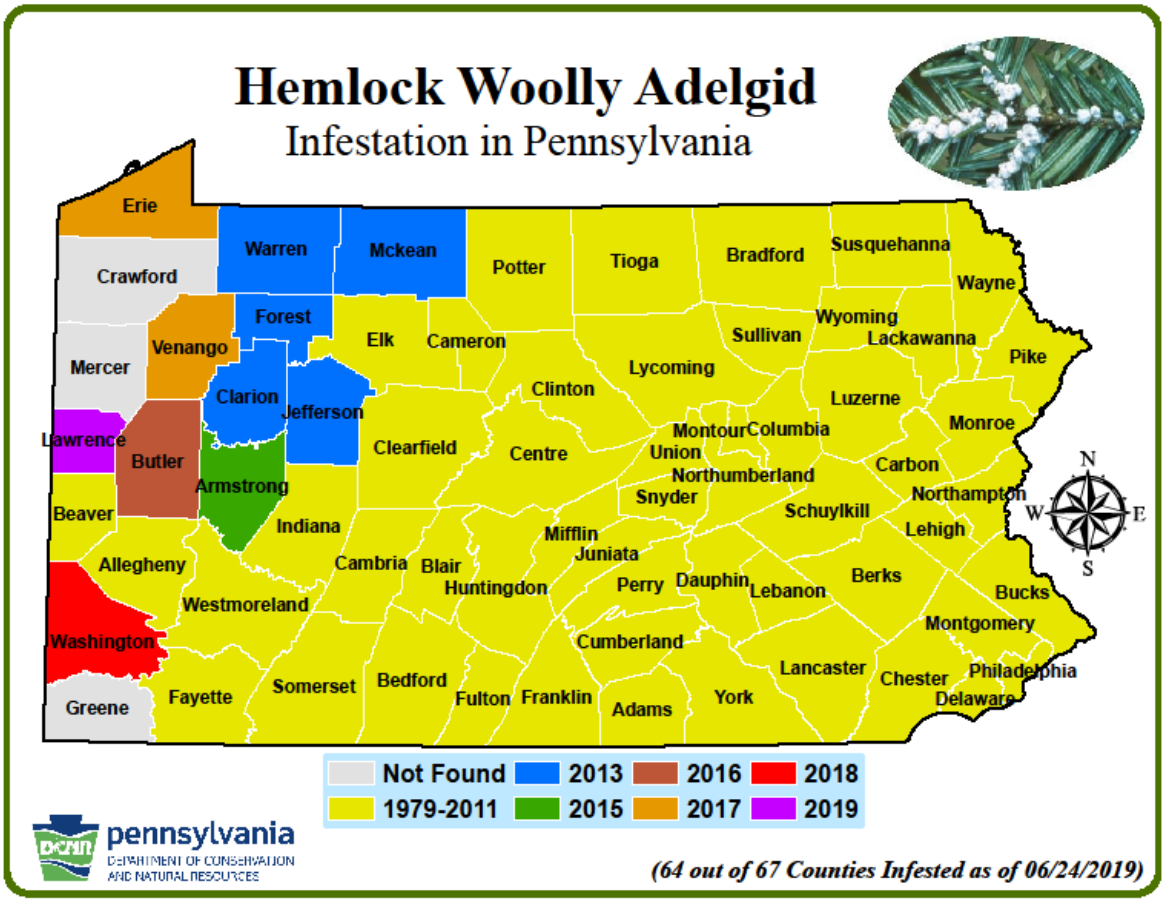
The magnitude of invasive species threats ranges from nuisance to widespread killer. Some invasive species are not considered agricultural pests, and do not harm humans or cause significant ecological problems. For example, Brown Marmorated Stink Bugs are not considered to be an agricultural pest and do not harm humans. Other invasive species can have many negative impacts and cause significant changes in the composition of ecosystems. For example, the Emerald Ash Borer creates a 99% mortality rate for any ash tree it infects. The aggressive nature of many invasive species can cause significant reductions in biodiversity by crowding out native species. This can affect the health of individual host organisms as well as the overall well-being of the affected ecosystem. An example of a worst-case scenario for invasive species is the success of the Emerald Ash Borer in Monroe County and the surrounding region. The Emerald Ash Borer has already become established in Monroe County (see *Figure 28 - Emerald Ash Borer Infestation in Pennsylvania*) and the surrounding region, and there is a high mortality rate for trees associated with this pest.

Figure 28 - Emerald Ash Borer Infestation in Pennsylvania



Another example of a negative invasive pest is the hemlock woolly adelgid. Hemlock woolly adelgid is a fluid-feeding insect that feeds on hemlock trees throughout eastern North America, including Pennsylvania. The egg sacs of these insects look like the tips of cotton swabs clinging to the undersides of hemlock branches. Hemlock woolly adelgid was introduced from Asia into the Pacific Northwest in 1924. It was most likely introduced into the northeastern United States in the 1950s and it was first discovered in Pennsylvania in 1967. This insect has been damaging hemlock ever since and it is spreading. To date, sixty-four counties in Pennsylvania, including Monroe County, have been infested with this insect. See *Figure 29 - Hemlock Woolly Adelgid Infestation in Pennsylvania*. Eastern hemlock (Pennsylvania's state tree) and Carolina hemlocks (found further south in the Smoky Mountain sections of the Appalachians) are more susceptible to hemlock woolly adelgid damage than Asian and western hemlock trees due to feeding tolerance and predators that protect the latter species. Hemlock woolly adelgid sucks fluid from the base of hemlock needles. It may also inject toxins into the tree as it feeds, accelerating needle drop and branch dieback. Although some trees die within four years, trees often persist in a weakened state for many years. Hemlocks that have been affected by hemlock woolly adelgid often have a grayish-green appearance (hemlocks naturally have a shiny, dark green color).

Figure 29 - Hemlock Woolly Adelgid Infestation in Pennsylvania

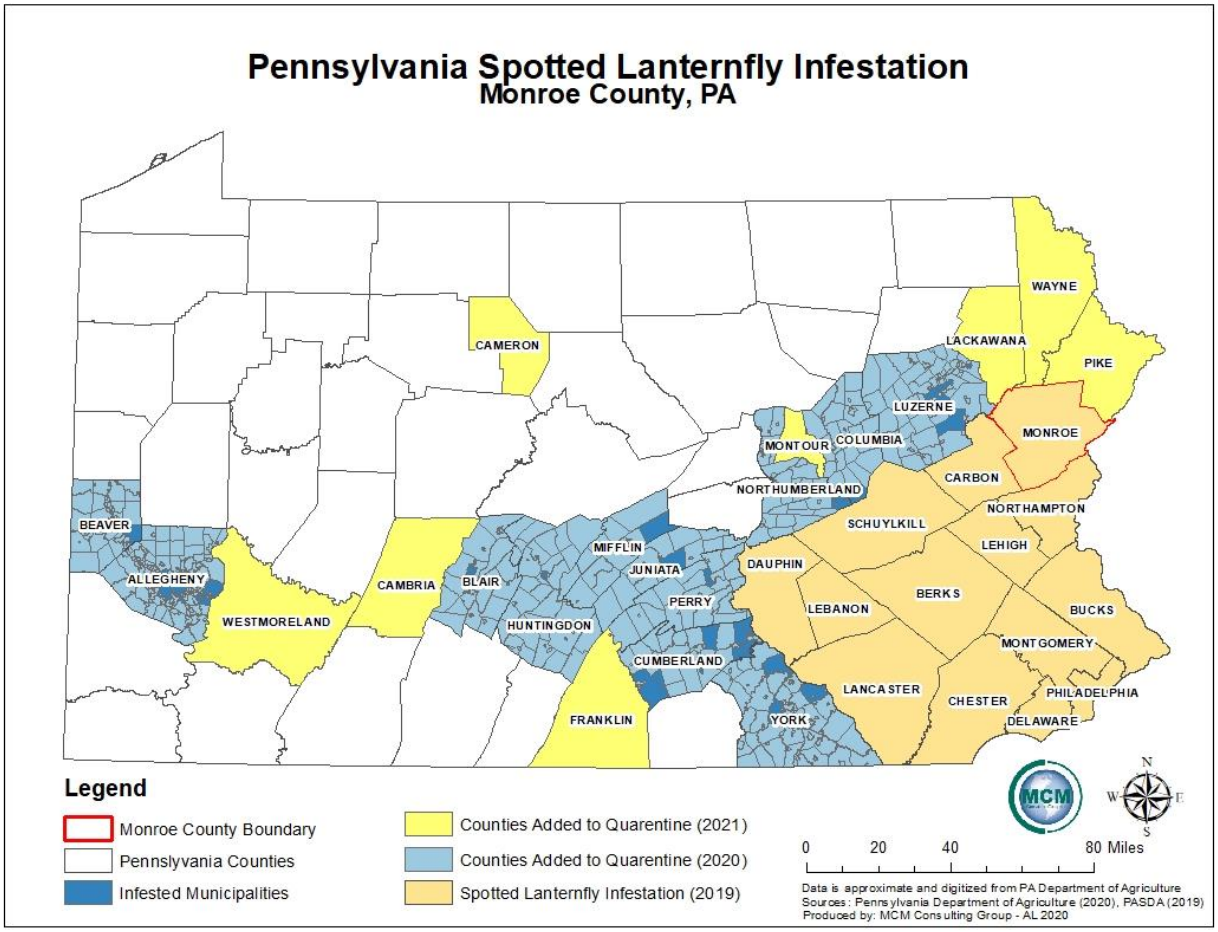


A final example of an invasive species is the Spotted Lanternfly. The Spotted Lanternfly, shown in *Figure 30 – A Group of Spotted Lantern Flies in Monroe County*, is a harmful invasive pest with a healthy appetite for our plants and can negatively impact the quality of life and enjoyment of the outdoors. According to the Penn State Extension, the Spotted Lanternfly is a significant threat to Pennsylvania agriculture, landscapes, and natural ecosystems, including grape, tree-fruit, hardwood, and nursery industries, which collectively are worth nearly $18 billion to the state's economy, outdoor recreation, and biodiversity. The Spotted Lanternfly was found in Monroe County during the year of 2019. However, since then, the Spotted Lanternfly is undoubtedly traveling west as the State Department of Agriculture announced on March 3, 2020 that an additional twelve counties in Pennsylvania were added to the quarantine area. As of March 2021, eight more counties have been added to the quarantine list which brings the total of counties up to thirty-four. The additional eight counties include Cambria, Cameron, Franklin, Lackawanna, Montour, Pike, Wayne, and Westmoreland. *Figure 31 – Pennsylvania Spotted Lanternfly Infestation* illustrates the counties in Pennsylvania that are in the quarantine zone for this pest.

Figure 30 - A Group of Spotted Lantern Flies in Monroe County

Image Provided by Monroe County OEM.

Figure 31 - Pennsylvania Spotted Lanternfly Infestation



The magnitude of an invasive species threat is generally amplified when the ecosystem or host species is already stressed, such as in times of drought. The already weakened state of the native ecosystem causes it to succumb to an infestation more easily. A worst-case example could be the Hemlock Woolly Adelgid causing reduced biodiversity, increased wildfire potential, and thermal harm to small stream cold water fisheries and habitats.

4.3.6.3 Past Occurrence

Invasive species have been entering Pennsylvania since the arrival of European settlers, but not all occurrences required government action. Monroe County is known for its great number of geographic features. There are various state game lands within the area which include state game lands 127, 168, 186, 221, and 38. Big Pocono State Park, Cherry Valley National Wildlife Refuge, Delaware State Forest, Gouldsboro State Park, and Pocono Lake Preserve are other well-known areas in the county that have great amounts of forest and lakes available for species to potentially invade. Due to the vast area of forests, there are many invasive terrestrial species that

have been widespread in Monroe County that are common problems throughout the Commonwealth. Some of the most popular problematic species in Monroe include:

- Common Reed
- Japanese Knotweed
- Japanese Barberry
- Tree-Of-Heaven
- Oriental Bittersweet

Since the past, many of the extreme problematic species have been around for many years. However, the most recent problematic species are the Emerald Ash Borer, Hemlock Wooly Adelgid, and the Spotted Lanternfly. In 2007, both the Emerald Ash Borer and Hemlock Wooly Adelgid were both newly spotted species that caused extreme damage. Even more recently than 2007, the Spotted Lanternfly appeared in Monroe County. In 2014, this invasive species welcomed itself to Pennsylvania, however, it was not until 2019 that Monroe County had entered the quarantine zone for the Spotted Lanternfly infestation.

Table 26 - Prevalent Invasive Species lists problematic non-native species that are established in Monroe County. While all species listed here are not native to Monroe County, those species highlighted in red are considered to pose a severe ecological threat than some of the others (Rank 1), species highlighted in yellow are considered to pose a significant ecological threat but not considered to spread as easily and aggressively (Rank 2), and species highlighted in green are considered to pose a lesser ecological threat (Rank 3).

Table 26 - Prevalent Invasive Species

Prevalent Invasive Species (EDDMaps, 2021; iMapInvasives, 2021; PA DCNR, 2019)		
Scientific Name	**Common Name**	**Type**
Lonicera spp	Bush Honeysuckle	Plant
Cirsium vulgare	Bull Thistle	Plant
Cirsium arvense	Canada Thistle	Plant
Cyprinus carpio	Common Carp	Animal
Phragmites australis ssp. australis	Common Reed	Plant
Tanacetum vulgare	Common Tansy	Plant
Agrilus planipennis	Emerald Ash Borer	Insect
Myriophyllum spicatum	Eurasian Watermilfoil	Plant
Alliaria petiolata	Garlic Mustard	Plant
Fallopia sachalinensis	Giant Knotweed	Plant
Lymantria dispar	Gypsy Moth	Insect
Adelges tsugae	Hemlock Woolly Adelgid	Insect

Scientific Name	Common Name	Type
Berberis thunbergii	Japanese Barberry	Plant
Lonicera japonica	Japanese Honeysuckle	Plant
Polygonum cuspidatum	Japanese Knotweed	Plant
Microstegium vimineum	Japanese Stiltgrass	Plant
Persicaria perfoliata	Mile-A-Minute Vine	Plant
Lonicera morrowii	Morrow's Honeysuckle	Plant
Rosa multiflora	Multiflora Rose	Plant
Celastrus orbiculata	Oriental Bittersweet	Plant
Lythrum salicaria	Purple Loosestrife	Plant
Lycroma delicatula	Spotted Lanternfly (Lycorma)	Insect
Ailanthus altissima	Tree-of-Heaven	Plant
Elaeagnus umbellata	Autumn Olive	Plant
Cryptococcus fagisuga	Beech Bark Disease	Disease
Tussilago farfara	Colt's-foot	Plant
Potamogeton crispus L.	Curly-leaved Pondweed	Plant
Popillia japonica	Japanese Beetle	Insect
Poa pratensis	Kentucky Bluegrass	Plant
Polygonum caespitosum	Oriental Lady's-thumb	Plant
Phalaris arundinacea	Reed Canary Grass	Plant
Centaurea stoebe ssp. micranthos	Spotted Knapweed	Plant
Anthoxanthum odoratum	Sweet Vernal Grass	Plant
Myosotis scorpioides	True Forget-me-not	Plant
Cronartium ribicola	White Pine Blister Rust	Disease
Halyomorpha halys	Brown Marmorated Stink Bug	Insect
Ophiognomonia clavigignenti-juglandacearum	Butternut Canker	Disease
Bromus tectorum L.	Cheatgrass	Plant
Solanum dulcamara	Climbing Nightshade	Plant
Hypericum perforatum	Common St. John's-wort	Plant
Holcus lanatus	Common Velvetgrass	Plant
Achillea millefolium	Common Yarrow	Plant
Discula destructiva	Dogwood Anthracnose	Disease
Convallaria majalis	European Lily-of-the-valley	Plant
Euphorbia esula	Leafy Spurge	Plant
Vinca minor	Lesser Periwinkle	Plant

Scientific Name	Common Name	Type
Artemisia vulgaris	Mugwort	Plant
Harmonia axyridis	Multicolored Asian Lady Beetle	Insect
Hieracium aurantiacum	Orange Hawkweed	Plant
Rumex acetosella	Sheep Sorrel	Plant
Rorippa nasturtium-aquaticum	Watercress	Plant

4.3.6.4 Future Occurrence

According to the Pennsylvania Invasive Species Council (PISC), the probability of future occurrence for invasive species threats is growing due to the increasing volume of transported goods, increasing efficiency and speed of transportation, and expanding international trade agreements. Expanded global trade has created opportunities for many organisms to be transported to and establish themselves in new counties and regions. In 2017, Pennsylvania alone imported over $83 billion in goods from abroad, including agricultural, forestry, and fishery goods that commonly carry unknow pests. Climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, pests can establish themselves in previously inhospitable climates. This also gives introduced species an earlier start and increases the magnitude of their growth, possibly shifting the dominance of ecosystems in the favor of non-native species. In order to combat the increase in future occurrences, the PISC released the Invasive Species Management Plan in April 2010 and updated the plan in 2017. The plan outlines the Commonwealth's goals for managing the spread of nonnative invasive species and creates a framework for responding to threats through research, action, public outreach, and communication. More information can be found here: https://www.agriculture.pa.gov/Plants_Land_Water/PlantIndustry/GISC/Pages/default.aspx.

There are several invasive species that are found near Monroe County but have not yet been detected inside the county (see *Table 27 – Future Invasive Species*). Especially in cases like this, control efforts, heightened awareness, and public outreach and education can help prevent an invasive species from becoming established in the future. Once a species is established, it is more difficult to eradicate it from an ecosystem meaning prevention is very important. The species that are labeled in red are listed as a Rank 1 species, which indicates a severe ecological threat to the environment. Therefore, Asiatic Clam, Eurasian Watermilfoil, European Water Chestnut, Glossy Buckhorn, Goatsrue, Japanese Hops, and Kudzu are all widespread and highly problematic in nearby counties but have not been reported in Monroe County (as shown highlighted in red in *Table 27 – Future Invasive Species*). The development of appropriate plans will assist the county in reducing the possibility of a future encounter with any of these species. It would be beneficial to the forests of Monroe County to work toward keeping these species out of the area.

Table 27 - Future Invasive Species

Future Invasive Species (EDDMaps, 2021; PA DCNR, 2019; iMapInvasives, 2021)		
Scientific Name	**Common Name**	**Type**
Corbicula fluminea	Asiatic Clam	Animal
Scolytus schevyrewi	Banded Elm Bark Beetle	Insect
Brassica nigra	Black Mustard	Plant
Otiorhynchus sulcatus	Black Vine Weevil	Insect
Linaria dalmatica	Dalmatian Toadflax	Plant
Myriophyllum spicatum	Eurasian Watermilfoil	Plant
Trapa natans	European Water Chestnut	Plant
Convolvulus arvensis	Field Bindweed	Plant
Frangula alnus	Glossy Buckthorn	Plant
Galega officinalis	Goatsrue	Plant
Humulus japonicus	Japanese Hops	Plant
Pueraria montana var. lobata	Kudzu	Plant
Pristiphora erichsonii	Larch Sawfly	Insect
Carduus nutans	Musk Thistle	Plant
Ligustrum spp.	Privet	Plant
Trachemys scripta elegans	Red-eared Slider	Amphibian
Cytisus scoparius L.	Scotch Broom	Plant
Bipalium pennsylvanicum Ogren	Three-Lined Land Planarian	Animal
Salix alba	White Willow	Plant

4.3.6.5 Vulnerability Assessment

Monroe County's vulnerability to invasion depends on the species in question. Human activity and mobility are ever increasing, and combined with the prospects of climate change, invasive species are becoming increasingly threatening. Invasive species can have adverse economic effects by impacting agriculture and logging activities. Natural forest ecosystems provide clean water, recreational opportunities, habitat for native wildlife, and places to enjoy the tranquility and transcendence of nature. The balance of forest ecosystems and forest health are vulnerable to invasive species threats. While there is significant acreage of wetlands, waterways, state parks, and game lands in Monroe County where forest managers can impact invasive species, private lands can provide refuge for invasive species if landowners are unaware of or apathetic towards the threat.

Since there are large swatches of public land in Monroe County, there is a risk of future damage from invasive species that are present in the area. With about 395,000 acres of total land in

Monroe County, there is vulnerability to various land sites and waterways. If an invasive species were to invade the popular terrestrial areas or waterways in Monroe, great devastation would occur. The invasion from an invasive species could cause damage to the scenic and natural resources needed in the county. Additionally, tourism for the county is vulnerable to the invasive species as well and would be affected if the parks were destroyed. Therefore, a great amount of land and native wildlife within Monroe County are at risk with the presence of invasive species.

An interesting facet of the invasive species problem in Pennsylvania is that deer do not eat many invasive plants, giving invasive species a competitive advantage over the native species that deer prefer. As such, the management of deer populations in Monroe County has a significant impact on the vulnerability of an ecosystem to invasive species, where overpopulation of deer favors invasive species.

The Governor's Invasive Species Council of Pennsylvania (PISC) has identified over 100 species threats that are or could potentially become significant in Pennsylvania. Of these threats, county and municipal leaders believe that the most significant are invasive forest pests like the Emerald Ash Borer, Hemlock Woolly Adelgid, the Spotted Lanternfly, and plants like the Tree-of-Heaven which all been identified red in *Table 26 - Prevalent Invasive Species* for priority species in Monroe County.

Due to the past experiences with invasive plants in the county, there are five primary components which help with managing invasive plants to lower vulnerability:

Prioritize: Public use areas such as state parks and other healthy forest ecosystems should be prioritized over developed and private areas. Locations with lower densities of invasive plants are often easier to control and should be given quick attention. Locations where humans are disturbing the landscape opens up niche space, and often times the aggressive invasive species move in faster than native species. Such locations include areas around road work, ditch/culvert work, logging activities, stream improvement/stabilization and bridge work. Some species pose a higher risk than others - invasive species are easiest to control before they become widespread and established in an area, and for that reason, species that are less widespread should be prioritized for management.

Locate: Detailed locations should be recorded for invasive plants so sites can be easily relocated, treated, and monitored.

Delineate: The scale and extent of the infestation should be recorded and mapped so that the progress of the infestation can be monitored.

Control: Methods of control depend on the specific infestation, but the most common approaches are mechanical (cutting and hand-pulling) and chemical (herbicide treatments).

Monitor: Identified sites should be monitored and revisited as often as several times in a growing season (depending on the location/species). Monitoring can allow for early detection of spreading infestations. Most importantly, it prevents a relapse towards full-blown infestation.

It is best to act before a species can become established in the county, so forest management such as park rangers should be aware of invasive species found nearby Monroe County but not yet present in the county (priority species in *Table 26 – Future Vulnerable Species*). Public outreach and education are important for these species to improve identification and prevention of invasion. Without action, due to the instances and extent of the current infestations, it is reasonable to project that the county's vulnerability will increase.

4.3.7. Pandemic and Infectious Disease

4.3.7.1 Location and Extent

Pandemic & Epidemic

An epidemic occurs when an infectious disease spreads more quickly than experts expect. It is characterized by very widespread growth or extent that spreads quickly and affects many individuals at the same time. When an epidemic occurs, it typically impacts a larger area than an outbreak would. The rise and decline in epidemic prevalence of an infectious disease is dependent on the transfer of an effective dose of the infectious agent from an infected individual to a susceptible one. After an epidemic has subsided, the affected host population contains a small proportion of susceptible individuals to whom reintroduction of the infection will not result in a new epidemic. Therefore, the host population develops an immunity to the epidemic disease, which is termed as herd immunity.

A pandemic is a disease outbreak that spreads across countries or continents, which affects the population of an extensive area. Extensive regions that could potentially be affected are several counties, states, or countries. When a pandemic is present, the event usually affects more people and takes more lives than an epidemic typically would. Pandemics are further described as an extensive epidemic. Generally, pandemic diseases cause sudden illness in all age groups on a global scale. Pandemics are continuous events in third-world countries but do not affect the United States as frequently. A pandemic is measured and defined by the spreading of a disease rather than the fatalities associated with it. There are various characteristics of a pandemic outbreak, such as large, rapid scale spread, overload of healthcare systems, inadequate medical supplies, and disruption of economy/society. While a pandemic may be characterized as a type of epidemic, an epidemic is not a type of pandemic. Pandemics travel more effectively than epidemics.

Each year, different strains of influenza are labeled as potential pandemic threats. Pandemics happen when novel (new) viruses emerge and can infect people easily and spread efficiently and

are sustained from person to person. In the event of a pandemic taking place in the eastern United States, the entirety of Monroe County would likely be impacted. Strains of influenza, or the flu, are highly contagious as they commonly attack the respiratory tract in humans. Influenza pandemic planning began in response to the H5N1 (avian) flu outbreak in Asia, Africa, Europe, the Pacific, and the Near East in the late 1990s and early 2000s. Avian flu did not reach pandemic proportions in the United States, but the country began planning for flu outbreaks.

The 2009 H1N1 flu virus resulted in seventy-eight deaths in Pennsylvania by the time the pandemic ended. Studies after the 2009 H1N1 influenza pandemic showed that the strain disproportionately impacted people younger than twenty-four years old. Schools have potential to become outbreak centers due to their large young adult populations, high levels of close social contact, and permeable boundaries. During a pandemic or disease outbreak, the population affected may exceed the seasonal norm of 1/3 of the student population. Because universities and schools can be sites of transmission, they may cause a virus to spread among the surrounding community as well.

On March 11, 2020, the World Health Organization (WHO) characterized the outbreak of a coronavirus disease as a pandemic. The virus was named “SARS-CoV-2” and the disease it causes is named “coronavirus disease 2019” (COVID-19). The virus mostly attacks the respiratory tract in humans but can cause further medical issues if the patient was previously considered high risk or immunocompromised. Both the upper respiratory tract, such as sinuses, nose, throat, and lower respiratory tract, such as windpipe and lungs, are initially infected as a result of the disease. Lungs are typically the first targeted organ in the body for COVID-19. Other organs that could possibly be infected by COVID-19 are the heart, brain, liver, and gastrointestinal tract. Coronaviruses are common in humans and many different species of animals including camels, cattle, cats, and bats. The disease is believed to have started in Wuhan Province, China in late 2019 and spread around the globe. The original source of viral transmission to humans remains unclear, as does whether the virus became pathogenic before or after the spillover event. The intermediate animal that passed the virus from bats to people has not been identified, however researchers believe it to be a wild species that is sold as food in the wet markets within Wuhan at the Huanan Seafood Market. The overall origin of the virus remains uncertain during the writing of this plan. However, as the WHO digs into the origin of the COVID-19 pandemic, more clues and evidence leading to the origination of the virus are becoming clearer due to the high research and scientific technology available in today’s medical fields. Public health officials say it is critical to determine the identification of the origin of the pandemic to take steps to avert future outbreaks and pandemics. Future prevention may take many years for completion. Currently, researchers of the WHO believe it to be a zoonotic disease with origination from an animal reservoir rather than bioterrorism or laboratory accidental.

Infectious Disease

Infectious diseases are illnesses caused by pathogenic organisms such as bacteria, viruses, fungi, or parasites. There are various types of bacterial organisms that live on and within the human system but are considered harmless due to the normal flora present. Organisms become harmful and cause disease when under certain conditions. The causes of infectious diseases vary. The sources of infectious disease occur from contaminated food or waterways, infected animals/livestock, infection from biological vectors such as mosquitoes, etc. Infectious diseases include influenza, rabies, Middle East Respiratory Syndrome (MERS), West Nile virus, Lyme Disease, Zika virus, and Ebola virus.

West Nile virus is contracted through a mosquito bite and is aided by warm temperatures and wet climates conducive to mosquito breeding, with most cases occurring between April and October. West Nile virus is a vector-borne disease. This means an animal, usually an insect or a tick, transmits parasitic microorganisms to people and animals, and therefore, the diseases they cause. The disease causes headaches, high fever, neck stiffness, disorientation, tremors, convulsions, muscle weakness, paralysis, and death in its most serious form.

Lyme Disease, spread by the bite of infected blacklegged ticks, is a bacterial disease with symptoms including fever, headaches, and characteristic skin rash. Untreated, Lyme Disease can spread to joints, the heart, and the nervous system (CDC, 2016). To prevent the disease, it is recommended to use insect repellent, remove ticks promptly, apply pesticides, and reduce tick habitat.

The Zika virus is another infectious disease that is spread by mosquito bites and it is related to West Nile virus. Zika virus can also be spread through sexual intercourse, blood transfusion, or passed from mother to child in the womb. The virus was first identified in 1947, but largely came to the attention of the United States in 2015 when there was an outbreak of Zika in Brazil. The direct illness caused by Zika can include fever, red eyes, joint pain, headache, and a rash, or sometimes no symptoms at all. Zika is problematic for pregnant mothers as the virus can result in microcephaly or cause other problems for brain development. For adults, the virus can be linked to increased incidence of Guillain-Barré syndrome.

Pandemic and infectious disease events cover a wide geographical area and can affect large populations, potentially including the entire population of the Commonwealth. The exact size and extent of an infected population is dependent upon how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in denser areas where there are large concentrations of people. The transmission rate of infectious disease will depend on the mode of transmission of a given illness. Pandemic events can also occur after other natural disasters, particularly floods, when there is the potential for bacteria to grow and contaminate.

4.3.7.2 Range of Magnitude

Pandemic & Epidemic

Public health emergencies typically occur on a regional basis. The magnitude of pandemic or infectious disease threat in the Commonwealth will range significantly depending on the aggressiveness of the virus in question, factors within the community that are impacted (medical care access, population density, etc.), and the ease of transmission. For example, approximately 80% of West Nile Virus cases are clinically asymptomatic. Therefore, approximately 20% of the cases result in mild infection, known as West Nile fever. However, there is a small percentage of cases that will result in severe neurological disease and even death.

Pandemic influenza has a higher transmission rate from person-to-person compared to the West Nile virus disease. However, advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. In the early 1900s, flu pandemics could cause tens of millions of deaths, while the 2009 Novel H1N1, known as swine flu, caused fewer than 20,000 deaths worldwide, and many people infected with swine flu in 2009 recovered without needing medical treatment. However, the modern flu viruses are still quite dangerous. About 70% of those who were hospitalized during the 2009 H1N1 flu virus in the United States belonged to a high-risk group. However, with the COVID-19 pandemic, the transmission rates are much higher than any previous outbreaks related to other members of the coronavirus family such as SARS-CoV and MERS-CoV. In the past 100 years, the globe did not face a microbial pandemic similar in scale to the COVID-19 pandemic. The worldwide transmission of COVID-19 from human to human is spreading like wildfire. The current data includes 26.8 million COVID-19 cases in 213 counties with more than 877,000 patient deaths; however, it is difficult to make a projection of the final outcomes with the COVID-19 pandemic. Of the six global outbreaks of viral infections, three were caused by coronaviruses (SARS, MERS, and COVID-19), of which COVID-19 is characterized by the most efficient and aggressive transmission.

High risk populations for diseases/illnesses include children, the elderly, pregnant women, and patients with reduced immune system capability. The advancements in medical technology help with previous and current pandemics. The wireless thermometer gun has become increasingly popular and beneficial to the COVID-19 pandemic by giving opportunity to measure individual's body temperatures without being in close contact. Additionally, the wireless thermometer gun assists with pinpointing individuals that may be COVID infected if the individual has a fever, which helps reduce spread of the disease. This important medical equipment is being used as checkpoints during the pandemic at various public destinations such as hospitals, nursing home facilities, airports, etc. Other advances in medical technology instruments for COVID-19 include vaccination advancements (such as new mRNA vaccines which has been seen with the Pfizer,

Moderna, and Johnson & Johnson vaccines), virus DNA sequencing, and molecular testing techniques for COVID-19 diagnosis.

Therefore, with advancements made during pandemics, such as the COVID-19 pandemic, the global effects of various outbreaks have drastically declined over the past century. While there are limited secondary hazards related to public health emergencies, an outbreak can cause a variety of general secondary effects. Civil disorder is the most likely secondary hazard to result from a public health emergency. Further potential secondary effects could include: a shortage of medical supplies and personnel; hoarding of household paper and cleaning supplies; school, business, and government closings; government restrictions on travel; low attendance at places of employment; and slowed productivity.

The seasonal flu is still present throughout the country during a pandemic. A pandemic illness is not identical to a seasonal flu, as explained in *Table 28 – Pandemic and Seasonal Flu Differences*. Predictability and regularity are factored into the reasoning behind less of a concern when dealing with seasonal flu. However, a pandemic is considered to be more severe than seasonal flu due to lack of these factors.

Table 28 - Pandemic and Seasonal Flu Differences

Pandemic and Seasonal Flu Differences		
	Seasonal Flu	**Pandemic**
What is it?	Influenza (flu) is a contagious respiratory illness caused by flu A and B viruses that infect the human respiratory tract.	A flu pandemic is a global outbreak of a new flu A virus in people that is very different from current and recently circulating seasonal flu A viruses.
Occurrence?	Epidemics of seasonal flu happen every year. Fall and winter is the most common time for flu in the United States.	Flu pandemics happen rarely. Five have happened within the last 100 years.
Transmission?	Flu viruses are thought to spread mainly from person to person through droplets made when someone with flu coughs, sneezes, or talks near a person (within 6 feet).	Pandemic flu viruses spread in the same way as seasonal flu, but a pandemic virus is likely to infect more people because fewer people have immunity to the pandemic flu virus.

Pandemic and Seasonal Flu Differences		
	Seasonal Flu	**Pandemic**
Vaccination?	Seasonal flu vaccines are made each year to vaccinate people against the seasonal flu. Typically, only one dose is needed.	Although the U.S. government maintains a limited stockpile of pre-pandemic flu vaccines, this inventory may not be widely available in the early stages of a pandemic.
High Risk Group?	Young children, people sixty-five years and older, pregnant women, and the immunocompromised are more likely to have serious flu complications.	In some past pandemics, healthy and young adults, along with the immunocompromised and elderly were at high risk for developing severe flu complications.

The World Health Organization (WHO) developed an alert system to help inform the world about the seriousness of a pandemic. The alert system has six phases, with Phase 1 being the lowest risk and Phase 6 being the greatest risk of pandemic. The phases were developed in 1999, but then revised in 2005 and 2009 to provide a global framework and aid countries in pandemic preparedness and response planning. The time after the first pandemic wave has been elaborated into post peak and post pandemic periods. These phases are listed below in *Table 29 - Pandemic Influenza Phases*.

Table 29 - Pandemic Influenza Phases

Pandemic Influenza Phases	
Phase	**Characteristics**
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.

Pandemic Influenza Phases	
Phase	**Characteristics**
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza virus able to sustain community-level outbreaks has been verified.
Phase 5	The same identified virus has caused sustained community level outbreaks in two or more countries in one WHO region.
Phase 6	The pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influence activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.
Source: (WHO, 2009)	

4.3.7.3 Past Occurrence

Pandemic & Epidemic

Several pandemic influenza outbreaks have occurred over the past 100 years that not only affected Monroe County but the United States as a whole. *Table 30 - Past Pandemic Events in the United States* illustrates the various past pandemic events that have occurred since the late 1800's. The worst recorded pandemic was the Spanish Flu, due to the amount of infection spread that was present in the world. The two most recent pandemics that have occurred in Monroe County and the United States are the swine flu/Novel H1N1 and COVID-19 pandemics, with COVID-19 having the highest transmission rates yet.

Spanish Flu

Prior to the COVID-19 world-wide pandemic, the 1918 influenza (Spanish Flu) pandemic was classified as the "Mother of all Pandemics". An estimated 1/3 of the world's population was

infected and had clinically apparent illnesses during the 1918 - 1919 influenza pandemic. Pennsylvania was one of the most affected states in the country because influenza tends to strike cities very hard. The Spanish Flu claimed 500,000 lives in the United States, which included Monroe County. Monroe County experienced 217 deaths related to the Spanish Flu with February 1920 being Monroe's deadliest month with thirty-four deaths. Therefore, Monroe County was seriously affected by the Spanish Flu Pandemic.

Swine Flu/H1N1

Monroe County was impacted by the H1N1 virus during 2009. The Pennsylvania Department of Health set up clinics throughout the county to administer vaccines. The Pennsylvania Department of Health confirmed 113 cases and sixteen deaths related to the swine flu in Monroe County.

COVID-19

This is an on-going pandemic at the time of the writing of this plan, so credible websites are used to provide the most up-to-date statistics. As of March 2021, Pennsylvania has an estimated 997,000 total cases and 24,876 deaths related to the COVID-19 pandemic occurred in the United States. The first cases in Pennsylvania were reported on March 6, 2020, in Delaware and Wayne counties. The first confirmed case of COVID-19 in Monroe County was on March 16th, 2020. As of March 2021, Monroe County alone has recorded 9,835 cases with 9,581 confirmed cases, 254 probable cases, and 48,494 negatives. Monroe County has a daily new case rate of 22.1%, an infection rate of 0.99%, and a positive test rate of 8.6%. A total of 272 deaths related to the COVID-19 pandemic have occurred in Monroe County. Currently, Monroe County is in the middle zone which indicates that cases per 100,000 population that about 5,500 to 6,500 are in Monroe. All twenty municipalities in Monroe County indicated an increase in the pandemic section of the risk assessment valuations. The biggest peak of known cases for Monroe County was on December 13th, 2020. Over the winter of 2020-2021, much of Pennsylvania was experiencing a dangerous number of daily cases. The cases and deaths in Monroe County are increasing. Therefore, exact numbers of deaths and cases are constantly changing. As of May 13, 2021, Pennsylvania is currently in vaccination Phase 2 which include any and all Pennsylvanians of the age twelve or above are eligible to receive the COVID-19 vaccine. The Phase 1A included long-term care facility residents, health care personnel, individuals of ages 65 or older, and the high-risk individuals. As of June 11th, 2021, between the three approved vaccines of Pfizer, Moderna, and Johnson & Johnson (the newly approved vaccine) a total of 5,899,476 of Pennsylvania residents have been fully vaccinated. With Monroe County specifically, a total of 6,856 individuals have been partially vaccinated which indicates that the person has received at least one COVID-19 vaccine but has not yet received the necessary number of vaccines at the recommended time intervals to be fully covered. At present, all COVID vaccines under EUA

require two dosages. Therefore, the individual partially covered has only received one dose in the two-dose series. Meanwhile 8,502 individuals in Monroe County have been fully vaccinated which indicates that the person has received the necessary number of COVID vaccines at the recommended time in intervals. Therefore, per 100,000 residents in Monroe County, 4,026.5 are vaccinated. Monroe County's vaccinated rate is 8.8%. To see more updated information, follow here: https://www.health.pa.gov/topics/disease/coronavirus/Pages/Cases.aspx.

Table 30 - Past Pandemic Events in the United States

Past Pandemic Events in the United States	
Year(s)	**Common Name**
1889	Russian Flu
1918	Spanish Flu/H1N1
1957	Asian Flu/H2N2
1968	Hong Kong Flu/H3N2
2009	Swine flu/Novel H1NI
2020	COVID-19
Sources: (WHO & CDC, 2020)	

Infectious Disease

Not only has Monroe County experienced past pandemic events, but the county has also experienced past infectious disease events. The two major infectious disease events experienced across Monroe County and Pennsylvania as a whole are the West Nile Virus and Lyme Disease. Due to large rural and wooded areas within the county, these infectious diseases thrive in Monroe County. Both diseases are transmitted by biological vectors which are found throughout the county.

West Nile Virus

West Nile virus reached the United States in 1999 and a year later was detected in Pennsylvania when mosquito pools, dead birds, and/or horses in nineteen counties tested positive for the virus. A comprehensive network has been developed in Pennsylvania that includes trapping mosquitoes, collecting dead birds, and monitoring horses, people and, in past years, sentinel chickens. 2018 had the most positive cases in Monroe County since 2015. *Table 31 - West Nile Virus Control Program in Monroe County Since 2015* outlines the West Nile Virus within Monroe County since 2015.

Table 31 - West Nile Virus Control Program in Monroe County Since 2015

West Nile Virus Control Program in Monroe County Since 2015				
Year	**Total Positives**	**Human Positives**	**Mosquito Positives**	**Bird Positives**
2020	4	0	4	0
2019	3	0	0	3
2018	34	2	30	2
2017	26	0	24	2
2016	0	0	0	0
2015	10	0	10	0
Source: (PA Department of Environmental Protection, 2020)				

Lyme Disease

Lyme Disease has been present in the United States and Monroe County for many years. More wooded areas, such as Monroe County, have higher cases due to ticks being the main biological vector. Lyme disease is found in all sixty-seven counties within Pennsylvania with a total of nearly 9,500 cases. Monroe County has approximately 16,090 confirmed cases of Lyme disease according to the CDC, which is higher than most counties. Monroe County experienced the highest number of positive cases in 2011 at 175 cases, compared to the lowest number of cases in 2013 at ninety-two cases. However, it is possible that numbers have risen dramatically due to lack of testing in previous years. Lyme disease case counts are alarming and consistently rising over the past several years. Although, it should be noted that information represented for each county "may vary with respect to the resources they have to devote to investigation of Lyme cases". It should also be noted that these figures represent a rough estimate of the Lyme disease burden in Monroe County. *Table 32 - Lyme Disease Data for Monroe County* outlines the Lyme Disease within Monroe County since 2013. Data after 2018 was not available at the time of the writing of this report.

Table 32 - Lyme Disease Data for Monroe County

Lyme Disease Data for Monroe County	
Year	**Total Positives**
2018	105
2017	175
2016	137
2015	131
2014	102
2013	92
Source: (PA Department of Environmental Protection, 2018)	

4.3.7.4 Future Occurrence

Pandemic & Epidemic

The probability of a widespread pandemic public health emergency is every ten years or less with varying degrees of severity. Minor outbreaks of less serious communicable disease, such as influenza, occur much more frequently. Monroe County is expected to undergo pandemic influenza outbreaks every 11 - 41 years according to historical data. Exact timing of pandemic influenza outbreaks is unpredictable, and complete avoidance of the events is nearly impossible. Therefore, future occurrences of pandemics and infectious disease are unclear. Future pandemics may also emerge from other diseases, especially invasive pathogens for which Monroe County and Pennsylvania as a whole lack natural immunity which adds to the uncertainty of future occurrences. With the current pandemic of COVID-19, the future is still unknown in regard to the disease due to the novelty of the virus.

Infectious Disease

Pandemic future occurrences have several unknown circumstances; however, future infectious disease occurrences are likely to occur in the future. Infectious diseases such as West Nile Virus, Influenza, and Lyme Disease have been present in Monroe County for many years and are expected to continue in the future of Monroe County.

West Nile Virus

The best defense against West Nile virus in the future is to remove mosquito breeding locations – stagnant water sources. Another defensive measure is to prevent insect bites by wearing shoes, socks, long pants, and a long-sleeved shirt when outdoors for long periods of time, or when mosquitoes are most active. Also, mosquito repellent can be used whenever people are outside.

Influenza

It is estimated that 5% - 25% of Pennsylvanians get the flu each year, and 120 - 2,000 die from complications of influenza. The CDC recommends that everyone six months and older get a flu vaccine every season. People who are at a high risk of serious flu illness should take flu antiviral drugs as soon as they get sick.

Lyme Disease

Lyme disease is best combated using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat. Once a person realizes they have been bitten by a tick, they should seek medical attention, as undetected Lyme Disease can seriously damage a body's musculoskeletal and nervous systems or result in death.

4.3.7.5 Vulnerability Assessment

It is extremely difficult to predict a pandemic or an epidemic. The severity of the next pandemic cannot be predicted, but modeling studies suggest the impact of a pandemic on the United States could be substantial. In the absence of any control measures (vaccination or drugs), it is estimated that a "medium-level" pandemic could cause 89,000 - 207,000 deaths, 314,000-734,000 hospitalizations, 18 to 42 million outpatient visits, and another 20 to 47 million sick people in the United States. Between 15% - 35% of the U.S. population could be affected by a pandemic, and the economic impact could range between $71.3 - $166.5 billion. This data for the current COVID-19 pandemic has fluctuated widely but, at the time of the writing of this plan, was on pace for greater than a "medium-level" pandemic. The COVID-19 pandemic has severely affected populations over the age of sixty-five, disproportionally to those in nursing homes. It has also severely affected different races disproportionately, e.g., non-Hispanic American Indian and Black people. The CDC reports that long-standing systemic health and social inequities have put some members of racial and ethnic minority groups at increased risk of getting COVID-19 or experiencing severe illness, regardless of age.

Elderly individuals, children, and immune-deficient individuals are most vulnerable to disease. Nursing facilities, personal care facilities, daycares, schools, and hospitals are considered more vulnerable since there are normally groups of these functional-needs populations present at the facilities. The spread of disease has increased due to the vulnerability and density of these populations. Congregate living facilities, including correctional institutions and dormitories would also be at an increased risk due to the difficulties in adhering to the social distancing required to help stop the spread of a pandemic. During the COVID-19 pandemic, nursing homes and personal care homes in Pennsylvania suffered staggering numbers of cases and deaths and several county jails and state correctional institutions reported wide community spread. Specifically, in Monroe County, nursing and personal care facilitates were critically affected by COVID-19. A total of eleven facilities in the county have had COVID-19 cases. With this number of infected facilities, about 494 cases were reported among the elderly residents and seventy-six cases were reported among the employees within these facilities. A total 112 deaths have occurred in these vulnerable populations. The major personal care facilities in Monroe County include Fitzmaurice Community Services Inc. with five total positive residents and zero deaths, Getz Personal Care Home with thirty-nine positive residents and five deaths, Glugo Lodge with sixteen positive residents and zero deaths, Grace Park with twenty-three positive residents and seven deaths, Mrs. Bush's Personal Care home one and two with a total of forty-seven positive residents and five deaths, Salisbury Behavioral Health with unavailable data, and Spring Village at Pocono with sixty-five positive residents and seventeen deaths. Health-care workers and those working in direct-care situations (such as correctional institutions or those who cannot social distance due to their jobs) are more likely to be exposed to a pandemic

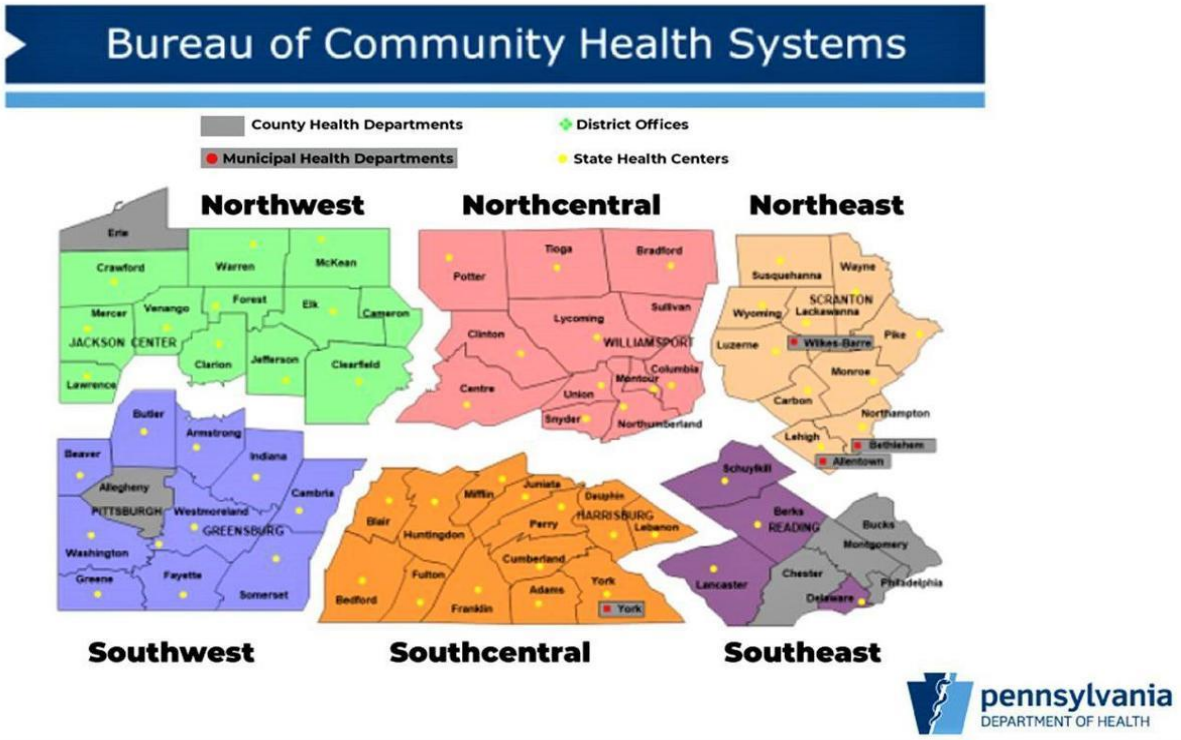
disease. Those that work outdoors for extended periods of time in warm months may be more vulnerable to West Nile, Lyme Disease or the Zika virus.

The number of hospitals and beds present in a county can affect the vulnerability impact on the county as well. The number of hospitals within the county and number of beds within the hospital determines the amount of care vulnerable and sick patients will receive in times of need. The vulnerable individuals will need access to hospitals and medical procedures as well. If sick and vulnerable patients are higher in number than beds available, the vulnerability rates within the county will rise. Within Monroe County, there are three major hospitals with numerous beds and various medical and emergency centers. The St. Luke's Hospital – Monroe Campus has ninety-eight beds and Lehigh Valley Hospital – Pocono has 192 beds. It is important to plan preparedness activities that will permit a prompt and effective public health response.

During a public health emergency, the PA DOH may open emergency medicine centers called points of dispensing (PODs) to ensure that medicine, supplies, vaccines, and information reach Pennsylvania residents during a public health emergency. An open POD is where the general public goes to receive free emergency medicine and supplies from public health officials, while a closed POD provides free emergency medicine and supplies to a specific community, like a university, including faculty, staff, and students. Dispensing of medications/vaccines is a core function of the Strategic National Stockpile's Mass Dispensing of Medical Countermeasures Plan.

PODs are coordinated with county emergency managers by the PA DOH with the six regional healthcare districts (see *Figure 32 - Pennsylvania Department of Health Districts*). Monroe County is in the northeast district. At the time of the writing of this plan, POD planning for mass vaccinations against COVID-19 is occurring and hundreds of locations are offering Pfizer, Moderna, and Johnson & Johnson vaccines.

Figure 32 - Pennsylvania Department of Health Districts



4.3.8. Tornado/Windstorm

4.3.8.1 Location and Extent

Tornadoes and windstorms can occur throughout Monroe County, though incidents are usually localized. Severe thunderstorms may result in conditions favorable for the formation of numerous or long-lived tornadoes. Tornadoes are nature's most violent storm and can cause fatalities and devastation to neighborhoods within the county. Tornadoes can occur at any time during the day or night but are most frequent during late afternoon into early evening, the warmest hours of the day, and most likely during the spring and early summer months of March through June. Tornado movement is characterized in two ways: direction/speed of spinning winds and forward movement of the tornado, also known as the storm track. The rotational wind speeds can range from 100 to more than 250 mph. The speed of forward motion can range from 0 mph to 50 mph. On estimate, the maximum velocity of tornadoes is about 300 mph. Forward motion of the tornado path can be a few to several hundred miles in length. Widths of tornadoes vary from less than 100 feet to more than a mile wide. The National Centers for Environmental Information (NCEI) reports that, "the maximum winds in tornadoes are often confined to extremely small areas and vary tremendously over short distances", which explains why one house may be completely demolished by a tornado and a neighboring house could be untouched. Some tornadoes never touch the ground and are short lived, while others may touch the ground

several times. There are two main types of tornadoes: supercell and non-supercell. Supercell tornadoes are the most common and often the most dangerous type of tornado. A rotating updraft is key to the development of a supercell and eventually a tornado. Once the updraft is rotating and being fed by warm air flowing in, the tornado is formed. The other type of tornado is categorized as non-supercell, which is not as commonly found. One type of non-supercell tornado is the "Quasi-Linear Convective Systems" (QLCS). The QLCS tornadoes typically arise during the late night or early morning hours. These types of tornadoes are weaker and more short-lived compared to super cell thunderstorms. However, the QLCS are more difficult to detect effectively. Another type of non-supercell tornado is a landspout. These tornadoes are narrow and rope-like funnels that form when the thunderstorm cloud is still growing with no rotating updraft which causes the spinning motion to appear near the ground more. Waterspouts are similar non-supercell tornadoes to the landspout but not likely to be found within Monroe County.

Windstorms may be caused by thunderstorms, hurricanes, and tornadoes, but the most frequent cause of windstorms in Pennsylvania is thunderstorms. Windstorms are defined as sustained wind speeds of 40 mph or greater, lasting for at least one hour, or winds of 58 mph or greater lasting for any duration. There are a wide variety of windstorm events that can take place in Monroe County: Straight-line wind, downdraft, macroburst, microburst, downburst, gust front, and derecho. Straight-line winds are the most common wind event. Straight-line winds are different than tornadic winds. A downdraft is a small-scale column of air that rapidly sinks toward the ground. A macroburst is the outward burst of strong winds that are near or at the surface with horizontal dimensions greater than 2 1/2 miles. Microburst winds may begin over a smaller area and then spread out to an even wider area, sometimes producing damage similar to a tornado. On the other hand, microbursts are smaller outward bursts of strong winds near or at the surface. Microbursts are less than 2 1/2 miles in horizontal dimension and are typically short-lived winds that last at maximum of ten minutes, with windspeeds reaching up to 100 mph. Microburst events can be wet or dry. Wet microbursts are typically associated with heavy precipitation at the surface. Dry microbursts, which are more commonly found in the western portion of the United States, do not have precipitation associated with them. Monroe County is more likely to experience a wet microburst instead of a dry microburst event. A downburst is typically used to describe the macro and microbursts. A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. The gust fronts are characterized by wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Derecho is a long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho contains various downbursts and microbursts. If the wind damage is more than 240 miles and includes wind gusts of at least 58 mph, the event would then be classified as a derecho.

4.3.8.2 Range of Magnitude

Each year, tornadoes account for $1.1 billion in damages and cause over eighty deaths nationally. Thus far, 2011 was the second worst year on record for deadly tornadoes, the worst being 1936. The number of tornado reports has increased by 14% since 1950. While the extent of tornado damage is usually localized, the vortex of extreme wind associated with a tornado can result in some of the most destructive forces on Earth. The damage caused by a tornado is a result of the high-wind velocity and windblown debris, also accompanied by lightning or large hail. The most violent tornadoes have rotating winds of 250 mph or more and are capable of causing extreme destruction and turning normally harmless objects into deadly projectiles.

Damages and deaths can be especially significant when tornadoes move through populated, developed areas. The destruction caused by tornadoes ranges from minor to severe depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light weight construction such as mobile homes. The Enhanced Fujita Scale, also known as the "EF-Scale", measures tornado strength and associated damages. The EF-Scale is an update to the earlier Fujita Scale, also known as the "F-Scale", that was published in 1971. These scales classify U.S. tornadoes into six intensity categories based upon the estimated maximum winds occurring within the wind vortex (*Table 34 - Enhanced Fujita Scale*). Although F-Scale has been used for many years, this scale has limitations associated with it. Limitations of the F-Scale include lack of damage indicators (DI), no account of construction quality and variability, and no definitive correlation between damage and wind speeds. The limitation is what led to a more accurate scaling method of the EF-Scale. The EF-Scale became effective on February 1st, 2007. Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon damage to buildings and structures. Previously recorded tornadoes are reported with the older F-Scale values, but *Table 34 - Enhanced Fujita Scale* shows F-Scale categories with corresponding EF-Scale wind speeds.

Figure 33 - Pennsylvania Wind Zones identifies wind speed zones across the state. The figure identifies wind speeds that could occur across the state to be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities. The majority of Pennsylvania falls within Zone III, meaning that design wind speeds for shelters and critical facilities should be able to withstand a three-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm incident. The western portion of the state falls within the Zone IV which indicates shelters can withstand up to 250 mph winds, while the eastern side falls within the Zone II where shelters can withstand up to only 160 mph. *Table 33 - Wind Zones and Counties Affected in Pennsylvania* identifies which county is located in specific wind zones throughout Pennsylvania. As shown in *Figure 33* and *Table 33*, Monroe County is situated in Wind Zone II.

Figure 33 - Pennsylvania Wind Zones

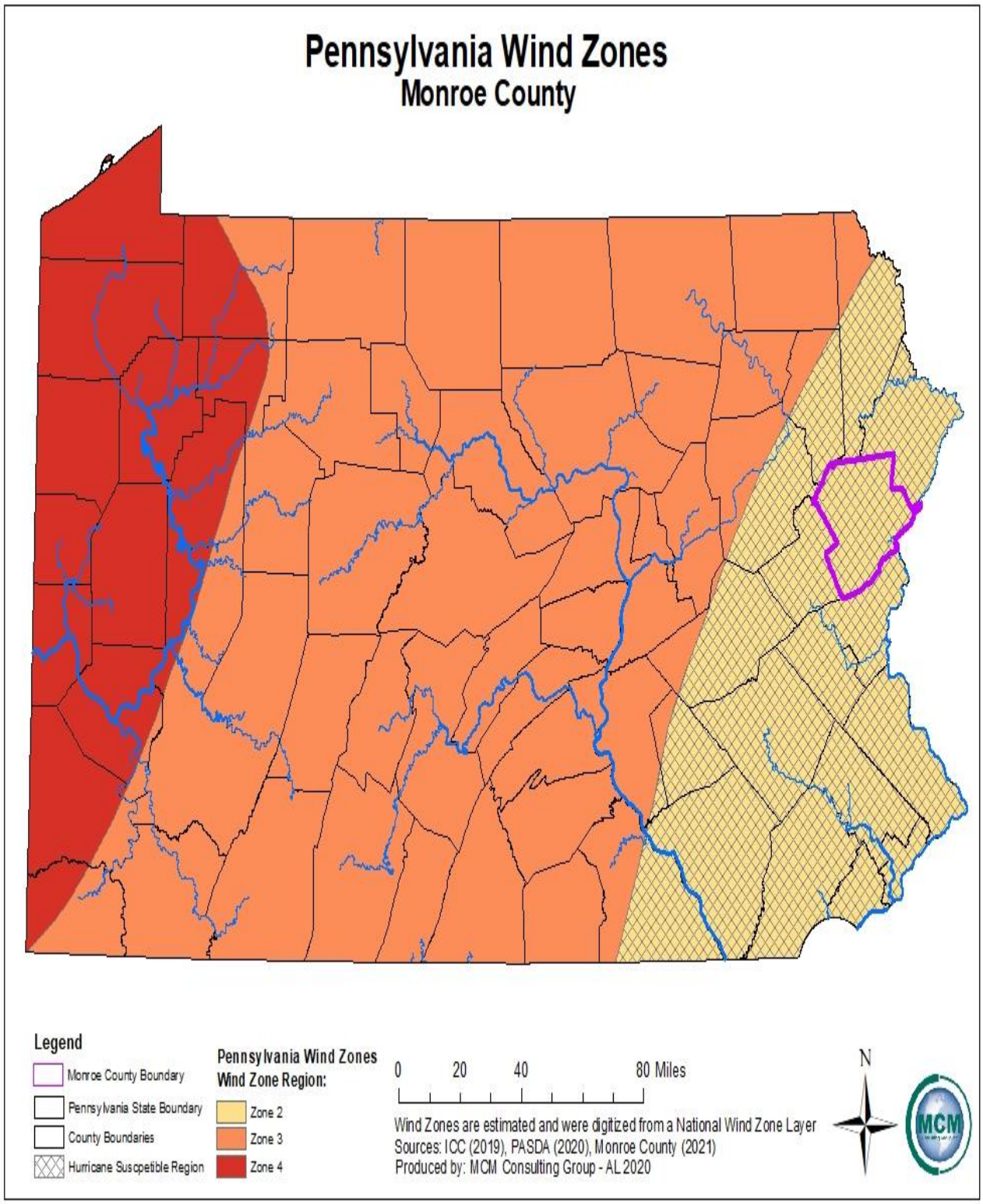


Table 33 - Wind Zones and Counties Affected in Pennsylvania

Wind Zones and Counties Affected in Pennsylvania (NOAA, 2019)	
Wind Zones with Speed	**Counties Affected**
Zone I (130 mph)	N/A
Zone II (160 mph)	Berks, Bucks, Carbon, Chester, Delaware, Lackawanna, Lancaster, Lebanon, Lehigh, Luzerne, **Monroe**, Montgomery, Northampton, Philadelphia, Pike, Schuylkill, Wayne, York
Zone III (200 mph)	Adams, Armstrong, Bedford, Blair, Bradford, Cambria, Cameron, Centre, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Elk, Fayette, Franklin, Fulton, Greene, Huntingdon, Indiana, Juniata, Jefferson, Lycoming, McKean, Mifflin, Montour, Northumberland, Perry, Potter, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Westmoreland,
Zone IV (250 mph)	Allegheny, Beaver, Butler, Clarion, Crawford, Erie, Forest, Lawrence, Mercer, Venango, Warren, Washington

Since Monroe County falls within Zone II, shelters and critical facilities should be designed to withstand up to 160 mph winds, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm event. Additionally, these structures should be able to withstand the wind speeds experienced in an EF3 tornado event. While it is difficult to pinpoint the exact locations at the greatest risk of a tornado, the southeast, southwest, and northwest sectors of the Commonwealth are more prone to tornadoes. Tornadoes can have varying secondary effects. The most common is power failure. The severe wind can dismantle power sources and cause significant structural damage. Hazardous material spills can occur if a tornado comes near a holding tank, or the spill stems from a traffic accident caused by high winds. Since tornado incidents are typically localized, environmental impacts are rarely widespread. However, where these incidents occur, severe damage to plant species is likely. This includes loss of trees and an increased threat of wildfire in areas where dead trees are not removed.

Tornadoes/windstorms of all types have caused the following problems within Monroe County:

- Power failures lasting four hours or longer.
- Loss of communications networks lasting four hours or more.
- Residents requiring evacuation or provision of supplies or temporary shelter.
- Severe crop loss or damage
- Trees down or snapped off high above the ground/tree debris-fire fuel.
- Toppled high-profile vehicles, including those containing hazardous materials.

Table 34 - Enhanced Fujita Scale

Enhanced Fujita Scale (NWS, 2007)			
EF-Scale Number	**Wind Speed (MPH)**	**F-Scale Number**	**Description of Potential Damage**
EF0	65–85	F0-F1	**Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	F1	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111–135	F1-F2	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136–165	F2-F3	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166–200	F3	**Devastating damage**: Well-constructed houses and whole frame houses completely leveled; cars thrown and small projectiles generated.
EF5	>200	F3-F6	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized projectiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

4.3.8.3 Past Occurrence

Monroe County has experienced fourteen tornado events since 1952 and thirty-five wind incidents since 1996 (see *Table 35 – Monroe County Tornado History* and *Table 36 – Monroe County High Wind History*). Numerous sources provide information in regard to past occurrences and losses associated with tornadoes/windstorms in Monroe County and the Commonwealth as a whole. Due to the number of sources available with information, specific number of events and losses could vary slightly in number. Tornado data was only available until 2018 while windstorm data was only available until 2019 even though more recent events could have possibly occurred. Historically, the county has experienced both severe windstorms and tornadoes.

The most recent tornado impact on McMichaels, Monroe County occurred October 2nd, 2018 when an EF1 was reported within the county. The path of this tornado event started with tree damage along Jackson Road and caused many uprooted and snapped trees. Additional tree damage was observed along Sportsmans Trail and Skyhawk Trail. The estimated maximum speed of this recent event ranged from 90 mph - 100 mph. An example of tornado damages can be seen in *Figure 34 – Property Damage is Assessed Following a Tornado*. The most damaging tornado event to affect Monroe County was an F3 on March 21st, 1976 which reported to have caused $2.5 million in damages, identified in red. From a relatively high magnitude tornado event, the damages were high in number as well. This F3 event was 100 yards wide and had a half-mile track that traveled through downtown Stroudsburg. The most dangerous tornado event to human safety and second most damaging tornado event was an EF-2 on July 1st, 2009 that caused two injuries and total of $1 million in damages. This tornado event impacted Bossardsville, Monroe County with a maximum speed of 120 mph. The worst damage occurred on Middle Road and Stroudsmoor Road when two men were injured, and about 10,000 homes/businesses without power. Hundreds of trees were damaged and at least twenty-five telephone poles needed to be replaced. Although this event occurred on the 1st of the month, complete power restoration did not occur until the 31st. This tornado event was on the ground for about 4.6 miles with a width of about 100 yards. The variety of past tornado events in Monroe County range from are F0/EF0 through F3/EF3 levels.

Figure 34 - Property Damage is Assessed Following a Tornado

Image Provided by Monroe County OEM.

The most recent wind incident in Monroe County occurred on February 24th, 2019 when a 51-magnitude wind event was reported. This wind event resulted in high winds around 50 mph - 60 mph that caused scattered power outages and downed trees across the county. Few minor structural damages occurred as a result. The most damaging wind incident to affect Monroe County was on September 18th, 2003 with a 50 mph magnitude wind event which reported to have caused $1 million in damages, identified in red. This damaging wind event was a result from Tropical Storm Isabel. One of the worst areas to get hit in Monroe County regarding this event was the Pocono Mountains Regional Airport.

See *Tables 35 – Monroe County Tornado History, Table 36- Monroe County High Wind History*, and *Figure 35 - Past Tornado Occurrences in Monroe County* below for reference to the past tornado and wind occurrence events and data within the county.

Table 35 - Monroe County Tornado History

Monroe County Tornado History (NOAA NCEI, 2020)					
Location	**Date**	**Magnitude (F/EF Scale)**	**Deaths**	**Injuries**	**Property Damage**
Monroe County	04/05/1952	F1	-	-	$2,500.00
Monroe County	09/13/2972	F2	-	-	$2,500.00
Monroe County	03/21/1976	F3	-	-	$2,500,000.00
Monroe County	10/05/1979	F0	-	-	$2,500.00

Location	Date	Magnitude (F/EF Scale)	Deaths	Injuries	Property Damage
Monroe County	10/05/1979	F2	-	-	$25,000.00
Monroe County	10/05/2979	F1	-	-	$2,500.00
Monroe County	08/29/1983	F0	-	-	$300.00
Monroe County	05/31/1985	F1	-	-	$2,500.00
Monroe County	06/13/1985	F1	-	-	$25,000.00
Kunkletown	11/08/1996	F1	-	-	$400,000.00
Buck Hill Falls	09/07/1998	F1	-	-	-
Syndersville	07/01/2001	F0	-	-	-
Bossardersville	07/29/2009	EF2	-	2	$1,000,000.00
McMichaels	10/02/2018	EF1	-	-	-
Totals	**14 events**	**-**	**0**	**2**	**$3,963,000.00**

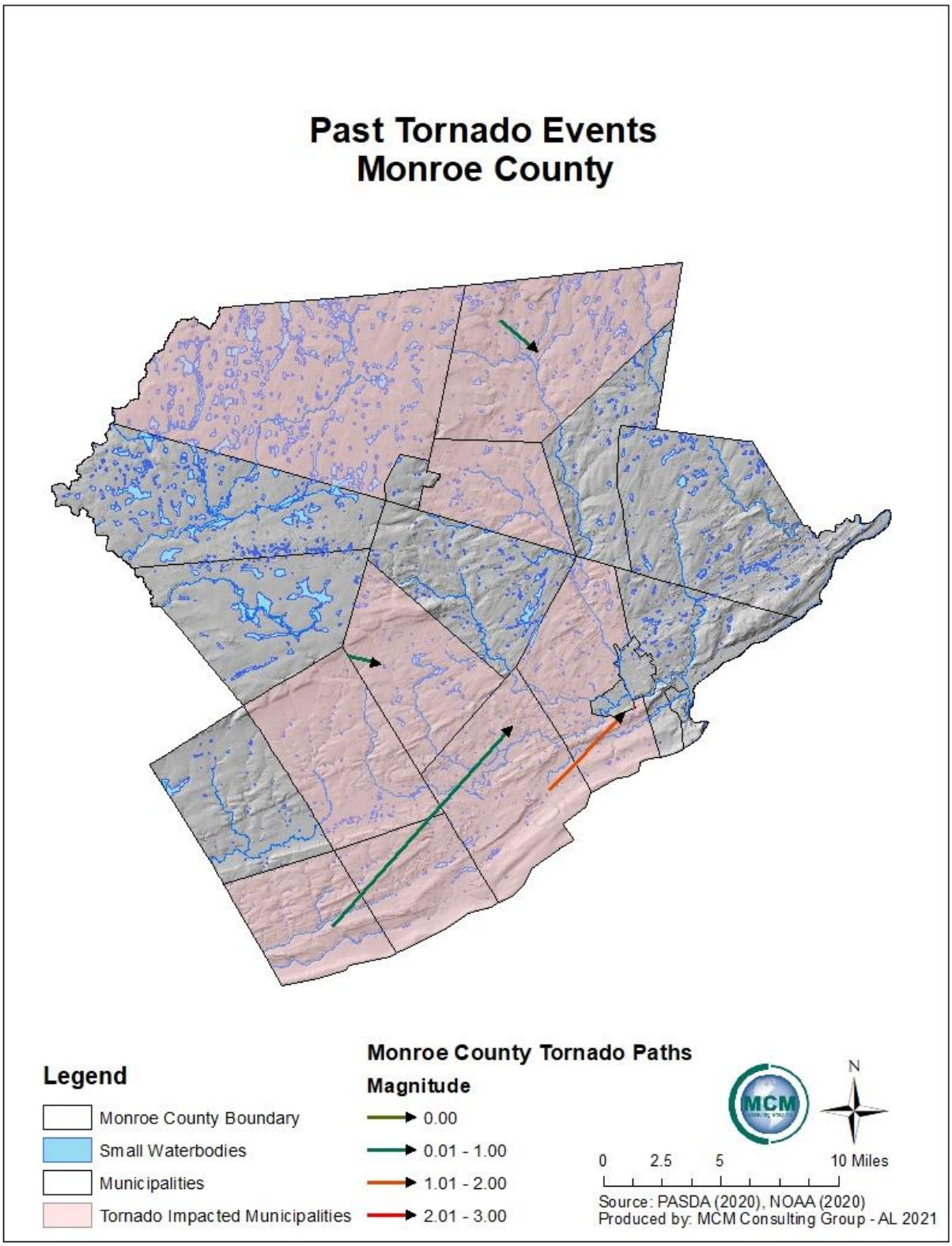
Table 36 - Monroe County High Wind History

Monroe County High Wind History (NOAA NCEI, 2020)				
Location	**Date**	**Mag. (knots)**	**Injuries**	**Property Damage**
Monroe County	01/19/1996	-	-	-
Monroe County	03/19/1996	-	-	-
Monroe County	09/16/1999	50 kts	-	$400,000.00
Monroe County	11/02/1999	50 kts	-	-
Monroe County	01/11/2000	-	-	-
Monroe County	01/11/2000	-	-	-
Monroe County	01/16/2000	-	-	-
Monroe County	04/08/2000	-	-	-
Monroe County	04/09/2000	-	-	-
Monroe County	12/12/2000	50 kts	-	$20,000.00
Monroe County	12/17/2000	-	-	-

Location	Date	Mag. (knots)	Injuries	Property Damage
Monroe County	02/10/2001	-	-	-
Monroe County	01/13/2002	-	-	-
Monroe County	02/1/2002	-	-	-
Monroe County	02/11/2002	-	-	-
Monroe County	03/10/2002	-	-	-
Monroe County	03/21/2002	-	-	-
Monroe County	09/11/2002	-	-	-
Monroe County	09/18/2003	50 kts	-	$1,000,000.00
Monroe County	11/13/2003	50 kts	-	$50,000.00
Monroe County	01/14/2006	53 kts	-	$100,000.00
Monroe County	02/17/2006	50 kts	-	$100,000.00
Monroe County	10/20/2006	53 kts	-	$5,000.00
Monroe County	12/01/2006	50 kts	-	$10,000.00
Monroe County	01/30/2008	50 kts	-	$10,000.00
Monroe County	01/03/2010	51 kts	-	$10,000.00
Monroe County	05/08/2010	50 kts	-	-
Monroe County	12/27/2010	54 kts	-	$5,000.00
Monroe County	10/29/2012	57 kts	-	$930,000.00
Monroe County	02/15/2015	50 kts	-	$25,000.00
Monroe County	04/03/2016	52 kts	-	-
Monroe County	04/03/2016	52 kts	-	-
Monroe County	03/02/2018	52 kts	-	-
Monroe County	04/04/2018	52 kts	-	-

Location	Date	Mag. (knots)	Injuries	Property Damage
Monroe County	02/24/2019	51 kts	-	-
Total	**35 events**	**-**	**-**	**$2,665,000.00**

Figure 35 - Past Tornado Occurrences in Monroe County



4.3.8.4 Future Occurrence

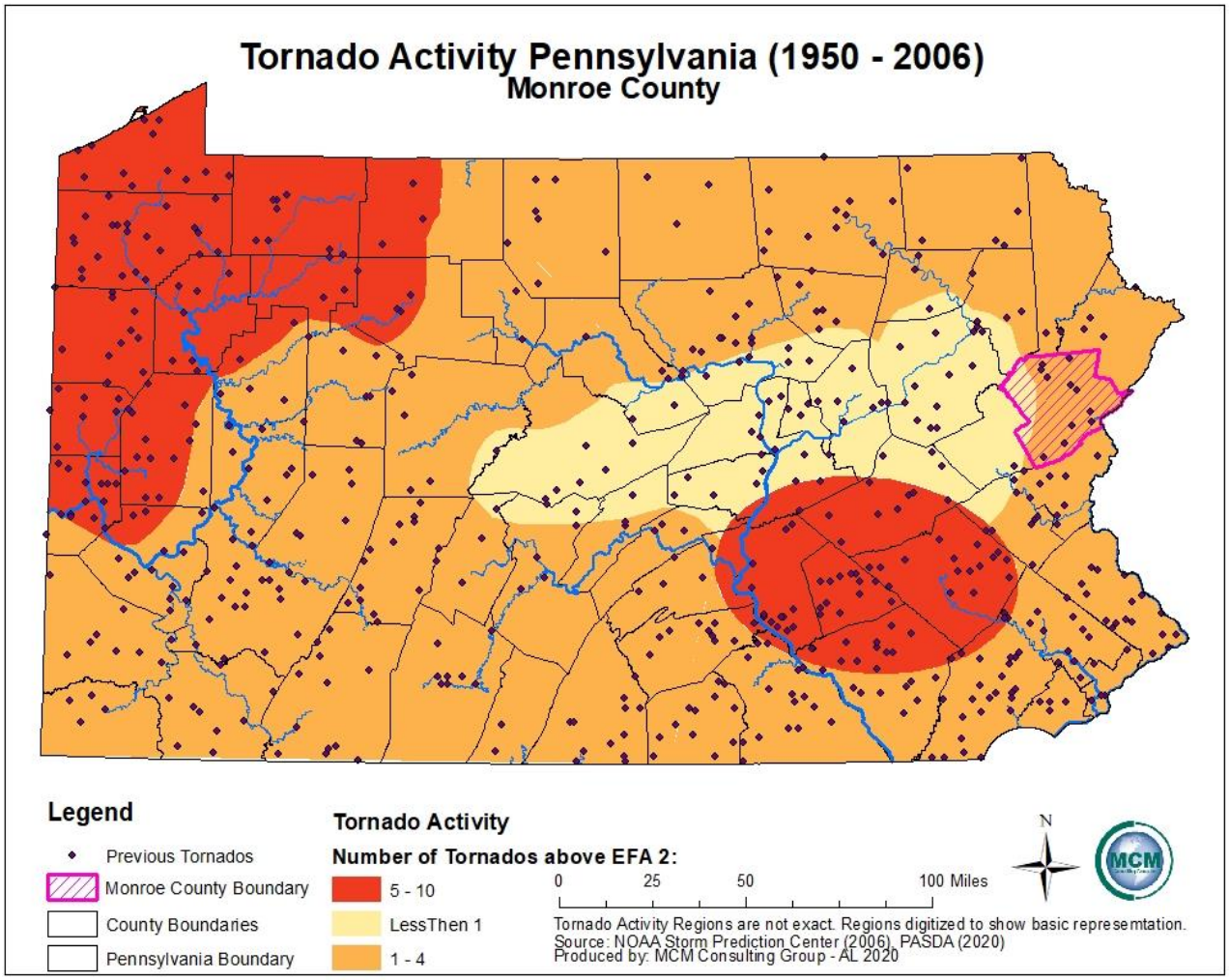
The future probability of a disastrous tornado hitting Monroe County is ranked as possible. According to the National Weather Service, the Commonwealth of Pennsylvania has an annual average of ten tornadoes with two related deaths. While the chance of being hit by a tornado in Monroe County is small, the damage that results when the tornado arrives is devastating. An EF-5 tornado with a 0.019% annual probability of occurring can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings. As the county's population continues to grow and as residential and commercial construction continues, the number of people and properties will be greatly affected by tornadoes and windstorms as they increase accordingly.

Based on historic patterns, tornadoes are unlikely to remain on the ground for long distances, especially in areas of the county with hilly terrain, such as Monroe County. However, the high historical number of windstorms with winds at or over 50 knots indicates that the annual chance of a windstorm in the county is higher. The number of days when tornadoes occur in the United States has decreased; however, there has been an increase in tornado activity on those days. The tornado season has also been lengthening, with the season starting earlier than it has historically. Pennsylvania had, for example, a record number of tornadoes in April and May 2019 compared to any other April or May on record. Climate change is causing temperatures and air moisture to increase, and it is thought that these changes could result in an increase in frequency and intensity of tornadoes and severe windstorms; however, there is somewhat low confidence in these conclusions and there is still much uncertainty. Therefore, the number of future tornado/windstorm events could potentially increase due to many factors.

Based on historical incidents, there are three zones in Pennsylvania that can either experience less than one, one to four, and five to ten of EF2 or above tornadoes per 3,700 square miles. Communities in Monroe County, as shown in the *Figure 36 - Tornado Activity in Monroe County* below, are expected to have one to four tornadoes annually. The approximation of one to four tornadoes annually assists with determining the rate of future tornado occurrences within Monroe County. Future tornadoes will be similar to those that affected the county in past events.

Windstorm events occur on a more frequent basis compared to tornadoes. Therefore, unlike tornadoes, this hazardous event has a highly likely probability for future events to occur within the county.

Figure 36 - Tornado Activity in Monroe County



4.3.8.5 Vulnerability Assessment

Tornadoes can occur at any time of the year, though they are more likely during peak months, which are during the summer for the northern part of the United States, such as Pennsylvania. While the frequency of windstorms and minor tornadoes is expected to remain relatively constant, vulnerability increases in more densely developed areas. Factors that impact the amount of damage caused by a tornado are the strength of the tornado, the time of day and the area of impact. Usually, such distinct funnel clouds are localized phenomena impacting a small area. However, the high winds of tornadoes make them one of the most destructive natural hazards. There can be many secondary impacts of tornadoes and windstorms, including transportation accidents, hazardous material spills, flooding, and power outages. A proper warning system is vital for the public to be informed of what to do and where to go.

Dangers that accompany thunderstorms associated with tornadoes which increase the vulnerability of Monroe County:

- Flash floods – with 146 deaths annually nationwide
- Lightning – 75 to 100 deaths annually nationwide
- Damaging straight-line winds – reaching 140 mph wind speed
- Large hail – can reach the size of a grapefruit and causes several $100 million in damages annually to property and crops.

Since high-wind incidents may affect the entire county, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Critical facilities are highly vulnerable to high windstorms and tornado events. While many severe storms can cause exterior damage to structures, tornadoes can also completely destroy structures, along with their surrounding infrastructure and abruptly halting operations. Tornadoes are often accompanied by severe storms which can be threatening to critical facilities within the county. Many secondary effects from these disasters can jeopardize the operation of these critical facilities as well. Critical facilities are particularly vulnerable to power outages which can leave facilities functionless, potentially crippling infrastructure supporting the population of the county. A storm potentially has the ability to destroy structures, citizens, and their possessions that are often left at the will of the storm. The elderly, disabled, special needs, and non-English speaking residents are at risk when faced with tornadoes. Without assistance to evacuate or difficulty understanding public information, they may be unable to prepare themselves or their homes and other possessions to safely endure the storm.

The economy of Monroe County is highly vulnerable to tornadoes. While there may be limited impact on the financial and commercial systems of the economy, these storms and the damage they result in can disrupt business for long term. The local economy is vulnerable due to possibility of being crippled by tornadoes and windstorms and their secondary effects when buildings and supporting infrastructure are destroyed in the storm. Power outages can create work stoppages while transportation accidents and road closures can limit the transportation of goods and services. Additionally, flooding cannot be discounted as it can destroy the physical structures, merchandise, and equipment essential for business operation. Monroe's environment is also vulnerable to tornado events. Most notably, hazardous materials spills can pollute ground water systems and vegetation. In the case of hazardous material spills caused by the event, the local environment can also be negatively impacted which requires extensive clean-up and mitigation efforts. Monroe County is considered a rural county that has a great amount of tourism that occurs due to the vast mountains and hills present. Not only is this environment of the mountains at risk, but the hikers and hunters within the area are as well. Consequently, in the event of a tornado or severe storm, these tourists have limited emergency notification measures which result in high vulnerability.

While the frequency of windstorms and minor tornadoes is expected to remain relatively constant, vulnerability increases in more densely developed areas. Since high wind events may affect the entire county, it is important to identify specific critical facilities and assets that are most vulnerable to this hazard. Due to their lightweight and often unanchored design, commercial trailers and mobile homes are also extremely vulnerable to high winds/tornadoes and will generally sustain the most damage. These structures represent a reasonable percentage of the occupied structures within the county. A majority of the mobile homes are found in Hamilton Township, Middle Smithfield Township, and Pocono Township, which makes these three municipalities more vulnerable to tornado events than others. Locations and numbers of mobile home parcels in Monroe County can be found in *Table 37 – Vulnerable Mobile Home Parcels in Monroe County*. While clearly an estimate, this enables the county to take a preliminary look at which jurisdictions are more vulnerable to mobile home damage.

Table 37 - Vulnerable Mobile Home Parcels in Monroe County

Vulnerable Mobile Home Parcels in Monroe County (Monroe County GIS, 2020)	
Municipality	**Number of Mobile Homes Parcels**
Coolbaugh Township	36
Hamilton Township	134
Middle Smithfield Township	240
Pocono Township	104
Polk Township	50
Ross Township	57
Smithfield Township	41
Tunkhannock Township	60
Total	**722**

4.3.9. Wildfire

4.3.9.1 Location and Extent

The most prevalent causes of devastating wildfires are droughts, lighting strikes, arson, human carelessness, and in rare circumstances, spontaneous combustion. Most fires in Pennsylvania are caused by anthropogenic fires such as debris burns that spread and get out of control. A fire, started in somebody's backyard, could travel through dead grasses and weeds into bordering woodlands starting a wildfire. Major urban fires can cause significant property damage, loss of life, and residential or business displacement. While wildfires are a natural and essential part of many native Pennsylvania ecosystems (e.g., pitch pine and scrub oak woodlands), wildfires can also cause devastating damage if they are undetected and allowed to propagate unfettered. Wildfires most often occur in less developed areas such as open fields, grass, dense brush, or

forests where they can spread rapidly by feeding off of vegetation and combustible fuels. Wildfires are most prevalent under prolonged dry and hot spells, or general drought conditions.

A large portion of Monroe County is covered by either farmland or forested areas, increasing the geographic extent of wildfire vulnerability in the county. Under dry conditions or droughts, wildfires have the potential to burn forests as well as croplands. For recreational enjoyment, the county boasts several local parks and natural areas that include a series of trail systems – all of which are at risk for wildfires.

4.3.9.2 Range of Magnitude

Forested areas, croplands and properties that are at the interface between wild lands and human development are most at risk for being impacted by and causing wildfires. If an urban fire or wildfire is not contained, secondary impacts such as power outages may result. Other negative impacts of wildfires include killing people, livestock, fish, and wildlife and destroying valuable property, timber, forage, recreational and scenic values. Wildfires can also cause severe erosion, silting of stream beds and reservoirs, and flooding due to a loss of ground cover.

Almost all of the wildfires in the county occur in remote areas or areas away from residential structures. Unlike the wildland fires that occur in other parts of the country and affect vast areas of land and residential communities, most fires in Monroe County are contained before they cause damage or extensive property loss. However, the county recognizes that wildfires of some magnitude will continue to occur in Monroe County, and will have more devastating effects if development in and/or around the natural areas increases.

The United States Forest Service utilizes the Forest Fire Assessment System to classify the dangers of wildfire. *Table 38 – Wildland Fire Assessment System* identifies each threat classification and provides a description of the level.

Table 38 - Wildland Fire Assessment System

Wildland Fire Assessment System *(U.S. Forest Service)*	
Rank	**Description**
Low (L)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.

Rank	Description
Moderate (M)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

4.3.9.3 Past Occurrence

The Pennsylvania Department of Conservation and Natural Resources (DCNR) has an extensive history of reported wildfires in its state forestry system and districts. Historically, Monroe County experiences only a small number of these types of fires annually with all fires being relatively small. However, due to the many acres of farmland, forested areas, and open space in the county, under the right conditions the potential exists for a significant wildfire. Monroe County lies entirely within the Delaware Forest District (District 19) of the DCNR's Bureau of Forestry. This district encompasses Pike, Monroe, Northampton, and Carbon counties. In 2020, there were a total of sixty-one fires in District 19 that were responsible for destroying 853.7 acres. A major wildfire occurred over a five-day period in Monroe County between April 20th,

2016 and April 25th, 2016. The total acreage burned between those dates equals 8,032 acres. This constitutes a large wildfire when acreage is considered and remains the largest wildfire for the years 2000 through 2020.

District 19 reports the following twenty-one-year wildfire summary based on observed and reported wildfires. *Table 39 – Annual Summary of Wildfire Events* illustrates the number of acres burned in a certain number of fires for District 19 from the year 2000 to the year 2020.

Table 39 - Annual Summary of Wildfire Events

Annual Summary of Wildfire Events (DCNR 2021)		
Year	**Number of Fires**	**Acres**
2000	39	185.3
2001	56	82.8
2002	59	286.9
2003	28	41.8
2004	28	38.1
2005	80	137.2
2006	113	104.3
2007	69	61.7
2008	116	1121.8
2009	67	172.0
2010	38	68.4
2011	7	12.0
2012	26	42,7
2013	28	279.1
2014	24	660.7
2015	41	186.8
2016	37	8590.0
2017	12	143.1
2018	31	29.6
2019	22	12.5
2020	52	67.4

In recent years, the number of prescribed burns in Pennsylvania has been increasing. This corresponds to an embrace of the need for fire in many natural ecosystems and management strategies for reducing vulnerability to wildfire; it also improves hunting opportunities. In July of 2020 there were numerous prescribed burns in state-owned game lands.

4.3.9.4 Future Occurrence

Annual occurrence of urban fires and wildfires in Monroe County are expected. Urban fires are most often the result of human errors, outdated wiring and occasionally, malintent (arson). The occurrence of large scale and intense wildfires is somewhat unpredictable and highly dependent on environmental conditions and human response. Weather conditions play a major role in the occurrence of wildfires, so in the event of drought conditions, wildfire caution should be heightened. Any fire without the quick response or attention of firefighters, forestry personnel, or visitors to the forest, has the potential to become a wildfire.

Climate change is expected to bring an elongated wildfire season and more intense and long-burning fires (Pechony & Shindell, 2010). Unfortunately, in some regions of the United States, this is not a hypothetical, but a very real concern. Northern California has experienced unprecedented devastating wildfires in 2017, 2018, 2019, and 2020. The fires that have been occurring in California are thought to be burning faster and hotter due to worsening drought conditions caused by increased climate change (Cvijanovic et al., 2017). Wildfire conditions in Pennsylvania are not nearly as severe as in Northern California, but the intensification is a signal that the changes brought by climate change are not to be ignored. In Pennsylvania, higher air temperatures and earlier warming in the spring are expected to continue, resulting in more wildfire prone conditions in the summer and fall (Shortle et al., 2015).

4.3.9.5 Vulnerability Assessment

The size and impact of a wildfire depends on its location, climate conditions, and the response of firefighters. If the right conditions exist, these factors may often mitigate the effects of wildfires; however, during a drought, wildfires can be devastating. The highest risk for wildfires in Pennsylvania occurs during the spring (March to May) and the fall (October to November) months and 99% of all wildfires in Pennsylvania are caused by people. Approximately 83% of all Pennsylvania wildfires occur in the months outlined above. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris and increasing wildfire vulnerability. In the fall, the surplus of dried leaves is fuel for fires. *Figure 37 – Seasonal Wildfire Percentage* shows the wildfire percentage occurrence during each month occurring in Pennsylvania.

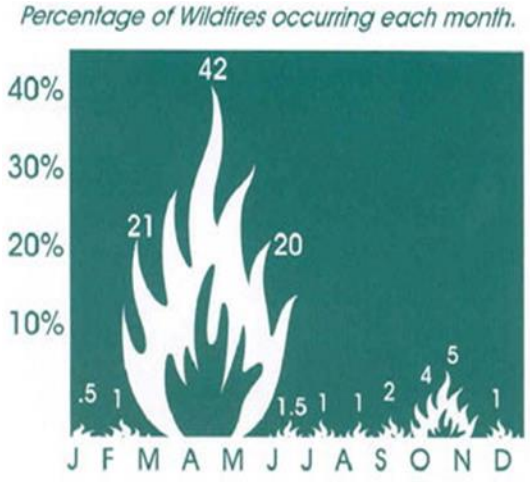
Firefighters and other first responders can encounter life-threatening situations due to forest and wildfires. Traffic accidents during a response and the impacts of fighting the fire once on scene are examples of first responder vulnerabilities.

The Wildland Urban Interface (WUI) was nationally mapped by a United States Department of Agriculture Forest Service effort in 2015 that used data from 1990-2010 to develop a robust dataset that related housing density and vegetative density. The dataset provides a way to identify locations where larger numbers of humans are living in or near natural areas that could

be at risk in the event of a wildfire. The WUI defines two types of communities – interface and intermix. Intermix refers to areas where housing and wildland vegetation intermingle, and interface refers to areas where housing is in the vicinity of a large area of dense wildland vegetation. The WUI was the fastest-growing land use type in the United States between 1990 and 2010. Factors behind the growth include population shifts, expansion of cities into the wildlands, and the expansion of new vegetation growth. The primary cause has been the migration of people, not vegetation growth.

Pennsylvania is among the states with the largest WUI and the most housing units in a WUI designated area. Pennsylvanians desire the proximity of natural beauty in their daily lives, and the growth in WUI housing noted above illustrates this. *Figure 38 – Wildland Urban Interface* shows the extent of Monroe County and the critical infrastructure facilities, functional needs facilities, and fire stations. Wildfire hazard is defined by conditions that affect wildfire ignition and/or behavior such as fuel, topography, and local weather. The many addressable structures in the Wildland Urban Interface and Intermix zones are broken up by assessed parcel use codes.

Figure 37 - Seasonal Wildfire Percentage



There are twenty-nine fire departments that serve Monroe County, a list of which can be seen in *Table 54 – Monroe County Fire Departments* of the emergency services profile. Each fire department conducts its own schedule of in-house training sessions for its members.

The response of firefighters is integral to the containment of wildfires in the county. The likelihood that some fire stations and services will close is a real threat to county communities' safety. *Figure 39 – Fire Station Locations* illustrates the position of fire stations and the location of state game lands, state forests, and natural areas within Monroe County. Some communities have already experienced the closure of services. It is recommended that each municipality assess their own vulnerabilities by maintaining and building a relationship with their local providers to plan accordingly for if a local service were to close. The statistics, response times, and call times associated with all units dispatched are easily obtainable from the local 911 center.

These departments need to have the ability to create and or discover new ways to recruit and retain volunteers. If left unattended, the issues will continue to devolve and worsen, and the lack of response will grow, leaving the community more vulnerable to loss of life and loss of property to the threats of wildfires.

At the time of this writing, it is possible the continuing COVID-19 pandemic will impact the availability of firefighters and their response times. Many fire departments have created and begun to enforce new regulations regarding responding to emergencies in the pandemic.

Continued efforts to inform the state legislature could prove to be paramount in assuring these services remain in operation into the future. At the time of this writing, a flurry of bills had been introduced to both the House of Representatives and the Senate as the result of a two-year study initiated in by Senate Resolutions (SR 6).

Figure 38 - Wildland Urban Interface

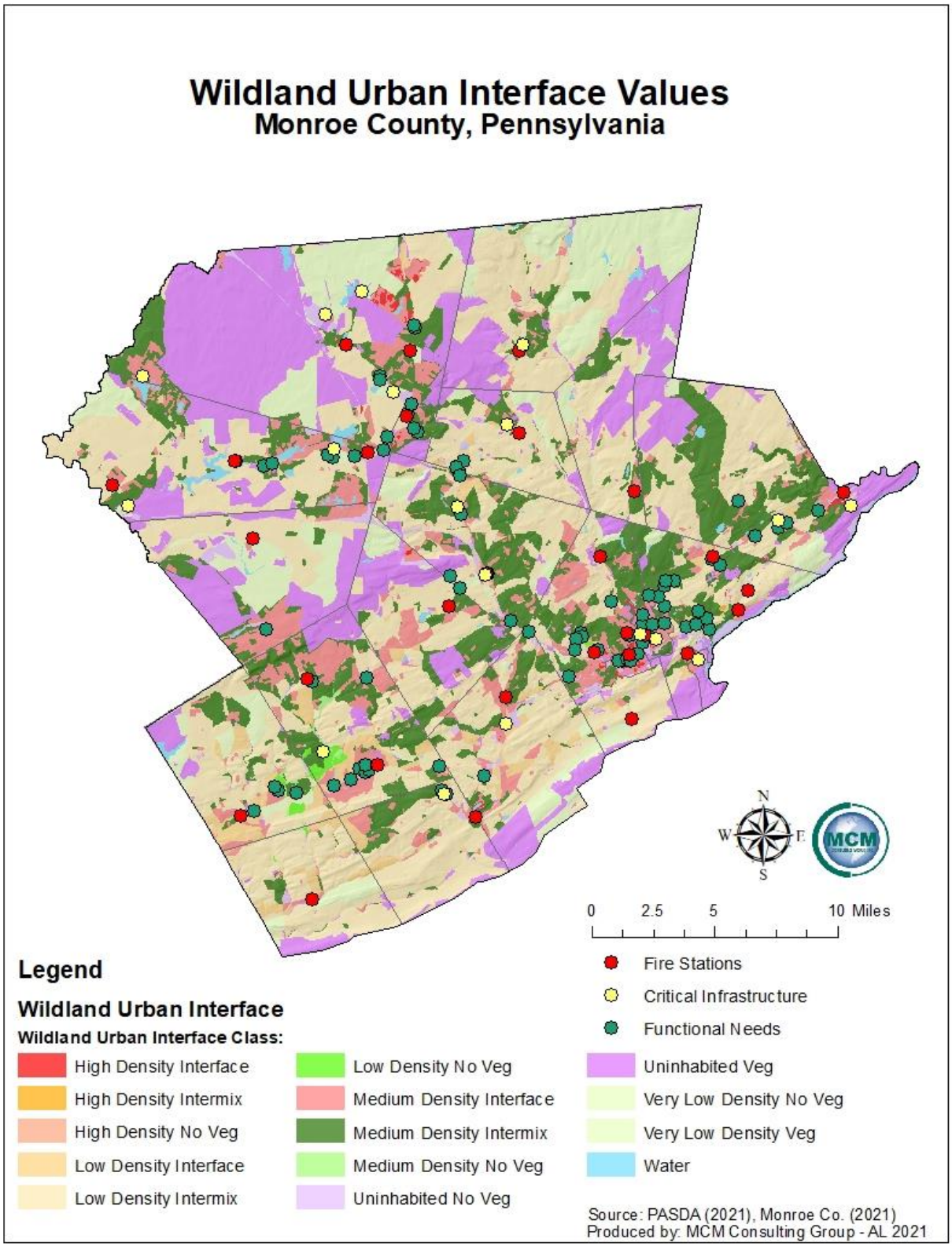
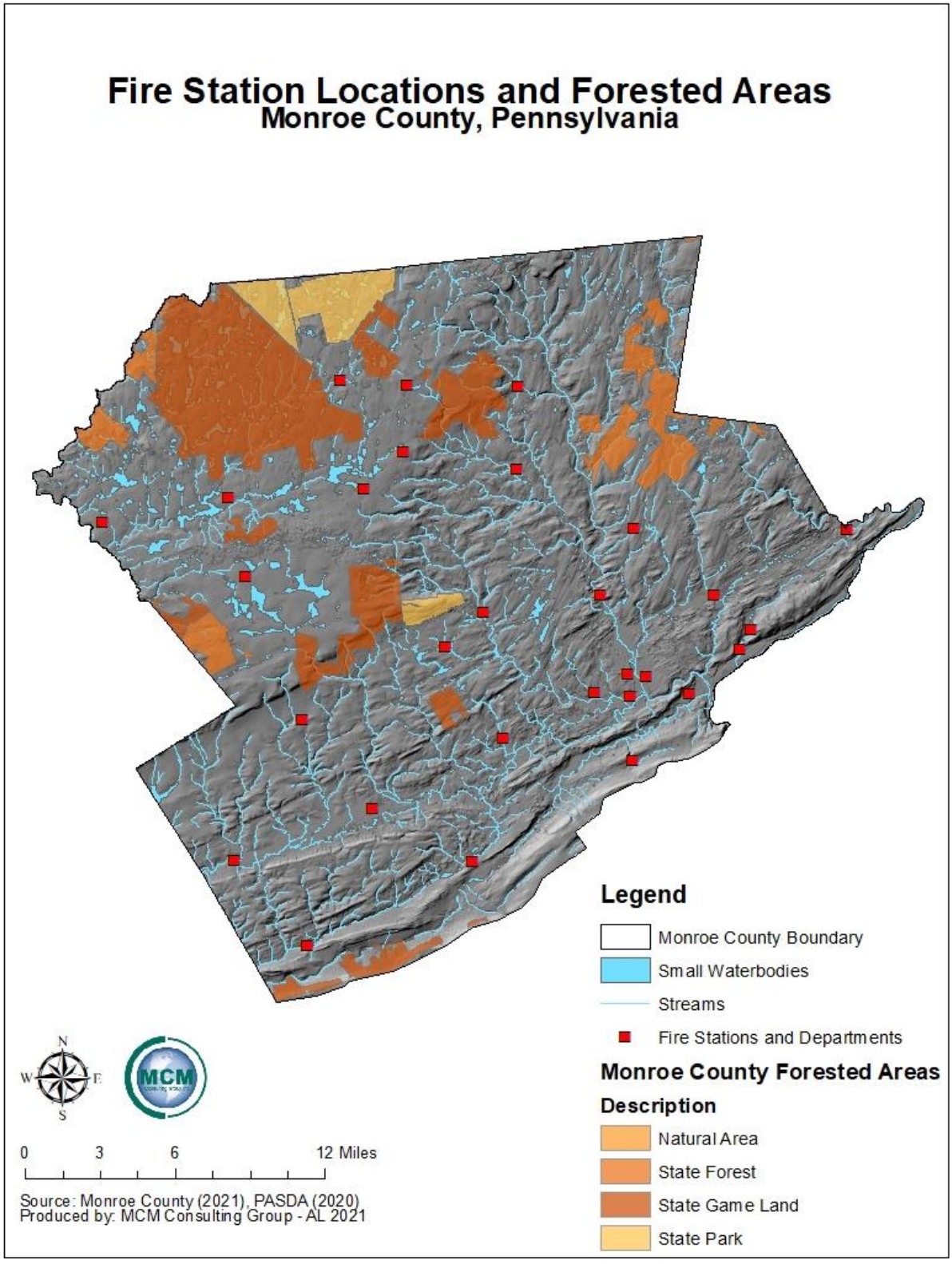


Figure 39 - Fire Station Locations



4.3.10. Winter Storms/Nor' Easter

4.3.10.1 Location and Extent

There is an average of thirty-five winter weather events that impact Pennsylvania each year. In Monroe County specifically, on average, winter weather events occur three times a year. Such winter storms are regional events, so each county in Pennsylvania shares these hazards; however, the northern tier, western counties and mountainous regions generally experience storms more frequently and with a greater severity due to lake effects and geographic influence. The extent of a severe winter storm can be classified by meteorological measurements and by evaluating the societal impacts.

On occasion, Monroe County can be affected by a nor'easter, depending on its track. A nor'easter is a storm characterized by a central low-pressure area that deepens dramatically as it moves northward along the U.S. East Coast. The name came from the strong northeast winds that precede and accompany the storm as it passes over New England. Nor'easters are notorious for producing heavy snow in the Central and Northeastern Mountains (including the Poconos), but typically make lighter snow, or even no snow, for counties in the west. Nor'easters will ordinarily produce a heavy, wet snow. There is usually a fairly consistent demarcation between rain, mixed precipitation, and snow which moves along with the storm and generally parallel to the track of the surface low. The demarcation typically pivots with the storm as the track changes direction. The mixed precipitation and rainfall are generated when warmer marine air is pulled into the storm. The heaviest snow in a nor'easter falls to the north and west of the track of the surface low (NWS). Specifically, with Monroe County, in November of 2012, a nor'easter impacted the county severely. The 2012 nor'easter occurred directly after Hurricane Sandy had impacted the county. Hurricane Sandy already had caused major damage to the county, however, additional utility outage issues as well as wind damage from the nor'easter contributed the overall damage.

4.3.10.2 Range and Magnitude

Winter storms and nor'easters are usually countywide hazard. Winter storms consist of cold temperatures, heavy snow or ice, and sometimes strong winds. Descriptions of types of winter storms can be found in *Table 40 - Winter Weather Events Descriptions*. Monroe County generally experiences one or more significant winter storms each year. The storms come in the form of snow, freezing rain, and sub-zero temperatures lasting for several days. During the winter months, approximately a fourth of the precipitation occurs in Monroe County as snow accumulation. The snow fall is generally from late November to early April, with the greatest monthly amounts occurring in December and January. Winter storms have caused power failures, loss of communications networks, road closings, disruption of EMS/fire response capabilities, and losses of water supplies throughout the county. Power outages, sometimes

caused by large amounts of snow or ice weighing on and breaking power lines, can result in a loss of heat for residential customers, potentially posing a threat to human life.

Table 40 - Winter Weather Events Descriptions

Winter Weather Event Descriptions (NWS, 2009)	
Weather Event	**Classification/Description**
Heavy Snowstorm	Accumulations of 4 inches or more in a 6-hour period, or 6 inches or more in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets which form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces posing hazards to pedestrians and motorists.
Ice Storm	Significant accumulations of rain or drizzle freezing on objects (trees, power lines, roadways, etc.) as it strikes them, causing slippery surfaces and damage from the sheer weight of ice accumulation.
Blizzard	Wind velocity of 35 miles per hour or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period of time.
Severe Blizzard	Wind velocity of 45 miles per hour, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

NOAA's National Centers for Environmental Information (NCEI) has produced the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the United States. The RSI ranks snowstorm impacts on a scale from one to five, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. However, RSI differs from these others because population is included. The RSI is based on spatial extent of the storm, the amount of snowfall, and the combination of these elements with population. Including population information ties the index to societal impacts. The RSI is an evolution of the Northeast Snowfall Impact Scale (NESIS), which NCEI, then NCDC, produced. *Table 41 – NOAA's RSI Scale Categories* show the RSI categories one through five with their related description. The United States, as a whole, is divided up into six easternmost climate regions which include Northern Rockies, Upper Midwest, Northeast, Ohio Valley, South, and Southeast. Monroe County, along with the Commonwealth, are located within the Northeast portion of the six.

Table 41 - NOAA's RSI Scale Categories

NOAA's RSI Scale Categories (NOAA & NCDC, 2011)		
Category	**RSI Value**	**Description**
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Monroe County and its municipalities are susceptible to the entire range of severe weather, from heavy snowstorm to severe blizzard. The worst-case scenario would be a series of multiple, severe blizzards causing major disruptions to utilities and transportation and limiting the effectiveness of emergency response activities.

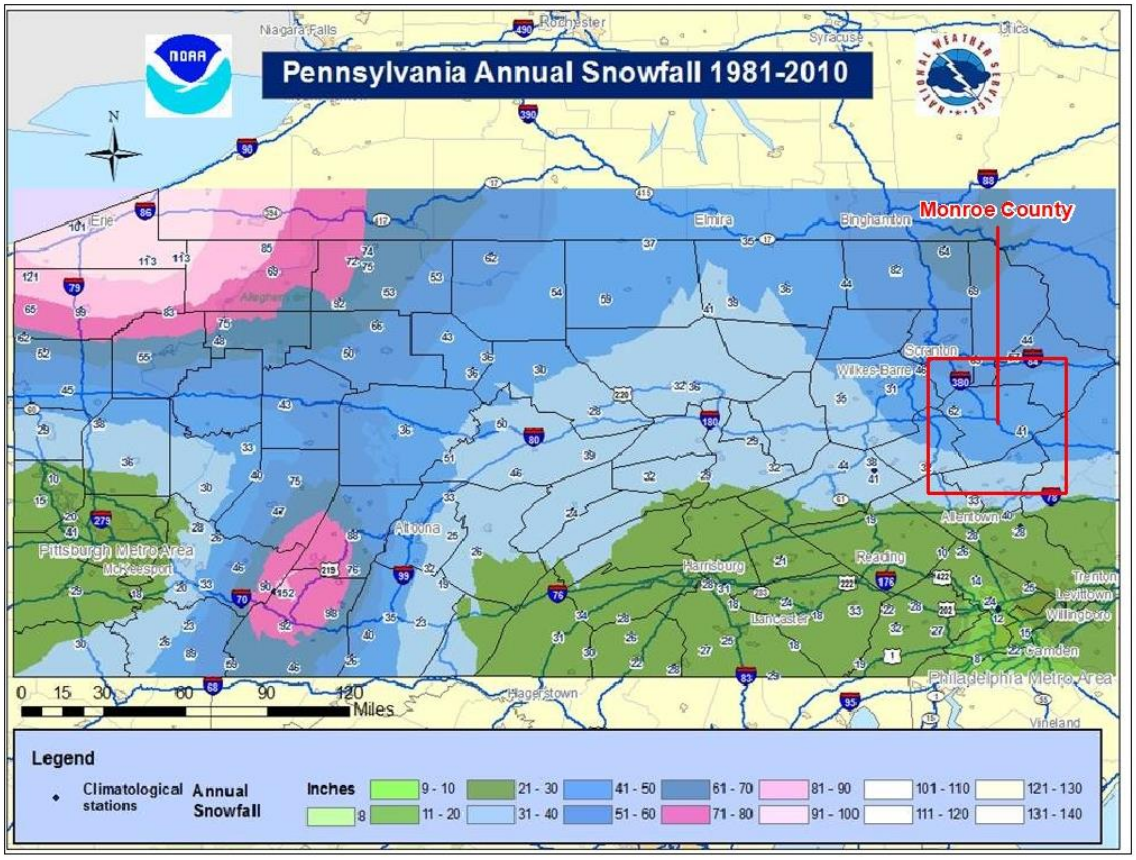
Long cold spells can cause rivers and lakes to freeze over. A subsequent thaw and rise in the water level break the ice into large chunks and can result in ice jams when the ice begins to flow. The ice jams can act as dams and result in flooding. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up and/or high winds which can break limbs or even bring down large trees. While gradual melting of snow and ice provides excellent groundwater recharge, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding. *Figure 40 - Pennsylvania Annual Snowfall 1981-2010* shows average annual snowfall in Monroe County to be anywhere between from 31 and 51 inches. Three of the Presidential Disaster and Emergency Declarations affecting Monroe have been in response to hazard events related to winter storms. More specifically, *Table 42 – Monthly Snowfall Average* illustrates the snowfall average for each month experienced in Monroe County.

Table 42 - Monthly Snowfall Average

Monthly Snowfall Average (NOAA, 2020)			
Month	**Monroe County**	**Month**	**Monroe County**
January	14.6”	July	0.0”
February	11.5”	August	0.0”
March	9.2”	September	0.0”
April	2.9”	October	0.0”
May	0.0”	November	2.0”

Month	Monroe County	Month	Monroe County
June	0.0”	December	9.0”
		Annual	49.2”

Figure 40 - Pennsylvania Annual Snowfall 1981-2010



4.3.10.3 Past Occurrence

Due to a great number of various sources in regard to winter storm events in Monroe County, loss and impact information for these events may vary depending on the source. All data present in this profile occurred from year 1993 to present. Although more current events could have occurred in the county, the data source had only given up to year 2016 for heavy snow and ice storm events. According to NOAA-NCEI, Monroe County underwent seventy-five winter storm events, 273 winter weather events, four sleet events, fifty-three heavy snow events, and eleven ice storm events. The impact of some of these events is shown in *Figure 41 – Assortment of Winter Storm Hazards in Monroe County.*

With the winter storm events, there was a total of one death on January 2nd, 1999 event and seventeen injuries total on both January 13th, 1999 and January 27th, 2009. Additionally, there

was a total of $10.9 million damages that occurred in Monroe County that was associated with winter storm events. The highest amount of damage was during the January 5th, 2005 event with approximately $10 million in damages. The other damage events occurred during December 24th, 2002 event with $15,000.00 in damage, February 12th, 2008 with $50,000.00 in damage, and February 12th, 2014 with $25,000.00 in damage. All these events have been identified in red and can be found in *Table 43*.

Figure 41 - Assortment of Winter Storm Hazards in Monroe County

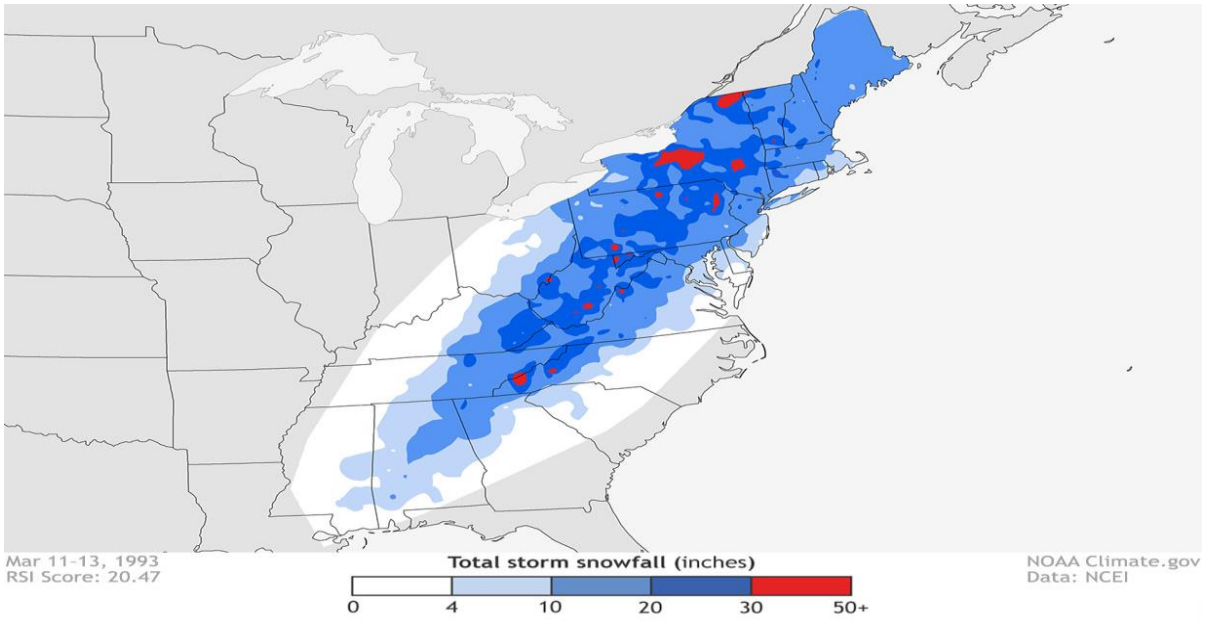
Images Provided by Monroe County OEM.

Along with the winter storm events were the winter weather events. There was a total of 273 winter weather events that occurred from 1996 to 2020. Due to the great number of winter weather events, there was not a table present for simplicity purposes.

A total of $1 million damages was recorded for the heavy snow events. This damage occurred during the February 16th, 2003 heavy snow event, indicated in red on *Table 45 – Monroe County Heavy Snow History*. The history of major winter storms and other related events in Monroe County since 1993 is outlined in *Table 43 – Monroe County Winter Storm History (NOAA, NCEI, 2020), Table 44 – Monroe County Sleet History, Table 45 – Monroe County Heavy Snow History,* and *Table 46 – Monroe County Ice Storm History.*

A severe winter event in the county's history and the Commonwealth as a whole was in the winter of 1994 when the state was hit by a series of protracted winter storms. The severity and nature of these storms combined with accompanying record-breaking frigid temperatures posed a major threat to the lives, safety and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals, and nursing homes. One of these devastating winter storms occurred in early January 1994 with record snowfall depths in many areas of the Commonwealth, strong winds and sleet/freezing rains. Numerous storm-related power outages were reported and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed which closed major arterial roads and downed many trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. Officials from PPL Corporation stated that this was the worst winter storm in the history of the company. Serious and sporadic power supply outages continued through mid-January in many locations due to record cold temperatures. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York and Virginia experienced fifteen to thirty minute rolling blackouts, threatening the lives of people and the safety of the facilities in which they resided. Power and fuel shortages affecting Pennsylvania and the East Coast power grid system required the Governor to recommend power conservation measures be taken by all commercial, residential, and industrial power consumers. The record cold conditions (with temperatures as low as -31˚F) resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. The extreme cold in conjunction with accumulations of frozen precipitation resulted in acute shortages of road salt. Trucks were dispatched to haul salt from New York to expedite deliveries to Pennsylvania Department of Transportation storage sites. For Monroe County, specific snowfall totals during that storm were not available, but the county noted this was one of the worst storms ever experienced. The year prior, the country's so-called "Storm of the Century" clobbered the east coast. See *Figure 42 - Storm of the Century Total Storm Snowfall*.

Figure 42 - Storm of the Century Total Storm Snowfall



On March 12–14, 1993, a massive storm system bore down on nearly half of the U.S. population. Causing approximately $5.5 billion in damages ($9.9 billion in 2020 dollars), America's "Storm of the Century", as it would become known, swept from the deep south all the way up the East Coast. With a central pressure usually found in category three hurricanes, the storm spawned tornadoes and left coastal flooding, crippling snow, and bone-chilling cold in its wake. Of the more than 250 weather and climate events with damages exceeding $1 billion since 1980, this storm remains the country's most costly winter storm to date.

Table 43 - Monroe County Winter Storm History (NOAA, NCEI, 2020)

Monroe County Winter Storm History (NOAA NCEI, 2020)					
Location	**Date**	**Event**	**Location**	**Date**	**Event**
Monroe County	01/02/1996	Winter Storm	Monroe County	12/15/2007	Winter Storm
Monroe County	03/07/1996	Winter Storm	Monroe County	02/01/2008	Winter Storm
Monroe County	01/16/1997	Winter Storm	Monroe County	02/12/2008	Winter Storm
Monroe County	02/14/1997	Winter Storm	Monroe County	02/21/2008	Winter Storm
Monroe County	11/13/1997	Winter Storm	Monroe County	12/10/2008	Winter Storm
Monroe County	12/22/1997	Winter Storm	Monroe County	12/19/2008	Winter Storm
Monroe County	12/29/1997	Winter Storm	Monroe County	01/06/2009	Winter Storm
Monroe County	01/23/1998	Winter Storm	Monroe County	01/10/2009	Winter Storm
Monroe County	02/23/1998	Winter Storm	Monroe County	01/27/2009	Winter Storm

Location	Date	Event	Location	Date	Event
Monroe County	03/21/1998	Winter Storm	Monroe County	12/08/2009	Winter Storm
Monroe County	01/02/1999	Winter Storm	Monroe County	02/09/2010	Winter Storm
Monroe County	01/08/1999	Winter Storm	Monroe County	02/22/2010	Winter Storm
Monroe County	01/13/1999	Winter Storm	Monroe County	02/25/2010	Winter Storm
Monroe County	02/18/2000	Winter Storm	Monroe County	01/17/2011	Winter Storm
Monroe County	12/13/2000	Winter Storm	Monroe County	02/01/2011	Winter Storm
Monroe County	01/20/2001	Winter Storm	Monroe County	03/22/2011	Winter Storm
Monroe County	02/25/2001	Winter Storm	Monroe County	12/26/2012	Winter Storm
Monroe County	03/04/2001	Winter Storm	Monroe County	02/08/2013	Winter Storm
Monroe County	11/16/2002	Winter Storm	Monroe County	03/18/2013	Winter Storm
Monroe County	12/11/2002	Winter Storm	Monroe County	12/14/2013	Winter Storm
Monroe County	12/24/2002	Winter Storm	Monroe County	02/05/2014	Winter Storm
Monroe County	01/02/2003	Winter Storm	Monroe County	02/12/2014	Winter Storm
Monroe County	12/05/2003	Winter Storm	Monroe County	11/26/2014	Winter Storm
Monroe County	12/14/2003	Winter Storm	Monroe County	02/01/2015	Winter Storm
Monroe County	01/27/2004	Winter Storm	Monroe County	01/23/2016	Winter Storm
Monroe County	02/03/2004	Winter Storm	Monroe County	02/09/2017	Winter Storm
Monroe County	02/06/2004	Winter Storm	Monroe County	12/09/2017	Winter Storm
Monroe County	03/16/2004	Winter Storm	Monroe County	01/17/2018	Winter Storm
Monroe County	01/05/2005	Winter Storm	Monroe County	03/02/2018	Winter Storm
Monroe County	02/20/2005	Winter Storm	Monroe County	03/06/2018	Winter Storm
Monroe County	3/23/2005	Winter Storm	Monroe County	03/21/2018	Winter Storm
Monroe County	12/16/2005	Winter Storm	Monroe County	04/02/2018	Winter Storm
Monroe County	01/03/2006	Winter Storm	Monroe County	01/19/2019	Winter Storm
Monroe County	01/23/2006	Winter Storm	Monroe County	02/11/2019	Winter Storm
Monroe County	02/12/2006	Winter Storm	Monroe County	03/03/2019	Winter Storm
Monroe County	03/02/2006	Winter Storm	Monroe County	12/01/2019	Winter Storm
Monroe County	02/13/2007	Winter Storm	Monroe County	12/16/2019	Winter Storm
Monroe County	12/02/2007	Winter Storm			

Table 44 - Monroe County Sleet History (NOAA, NCEI, 2020)

Monroe County Sleet History (NOAA, NCEI, 2020)		
Location	**Date**	**Event**
Monroe County	01/19/2001	Sleet
Monroe County	12/08/2001	Sleet
Monroe County	01/09/2002	Sleet
Monroe County	03/17/2002	Sleet

Table 45 - Monroe County Heavy Snow History (NOAA, NCEI, 2020)

Monroe County Heavy Snow History (NOAA NCEI, 2020)					
Location	**Date**	**Event**	**Location**	**Date**	**Event**
Monroe County	01/12/1996	Heavy Snow	Monroe County	01/06/2002	Heavy Snow
Monroe County	12/05/1996	Heavy Snow	Monroe County	01/07/2002	Heavy Snow
Monroe County	12/07/1996	Heavy Snow	Monroe County	01/19/2002	Heavy Snow
Monroe County	12/13/1996	Heavy Snow	Monroe County	03/20/2002	Heavy Snow
Monroe County	03/03/1997	Heavy Snow	Monroe County	03/21/2002	Heavy Snow
Monroe County	03/31/1997	Heavy Snow	Monroe County	10/29/2002	Heavy Snow
Monroe County	04/01/1997	Heavy Snow	Monroe County	11/26/2002	Heavy Snow
Monroe County	12/10/1997	Heavy Snow	Monroe County	12/05/2002	Heavy Snow
Monroe County	04/09/1998	Heavy Snow	Monroe County	02/06/2003	Heavy Snow
Monroe County	02/07/1999	Heavy Snow	Monroe County	02/16/2003	Heavy Snow
Monroe County	03/14/1999	Heavy Snow	Monroe County	03/06/2003	Heavy Snow
Monroe County	03/22/1999	Heavy Snow	Monroe County	01/14/2004	Heavy Snow
Monroe County	01/13/2000	Heavy Snow	Monroe County	03/18/2004	Heavy Snow
Monroe County	01/20/2000	Heavy Snow	Monroe County	01/22/2005	Heavy Snow
Monroe County	01/25/2000	Heavy Snow	Monroe County	02/28/2005	Heavy Snow
Monroe County	01/30/2000	Heavy Snow	Monroe County	03/01/2005	Heavy Snow
Monroe County	02/03/2000	Heavy Snow	Monroe County	12/09/2005	Heavy Snow
Monroe County	04/08/2000	Heavy Snow	Monroe County	03/16/2007	Heavy Snow
Monroe County	04/09/2000	Heavy Snow	Monroe County	11/18/2007	Heavy Snow
Monroe County	12/19/2000	Heavy Snow	Monroe County	10/27/2008	Heavy Snow
Monroe County	12/30/2000	Heavy Snow	Monroe County	01/26/2011	Heavy Snow

Location	Date	Event	Location	Date	Event
Monroe County	01/05/2001	Heavy Snow	Monroe County	02/20/2011	Heavy Snow
Monroe County	01/08/2001	Heavy Snow	Monroe County	10/29/2011	Heavy Snow
Monroe County	01/20/2001	Heavy Snow	Monroe County	01/02/2014	Heavy Snow
Monroe County	02/05/2001	Heavy Snow	Monroe County	01/23/2015	Heavy Snow
Monroe County	02/22/2001	Heavy Snow	Monroe County	11/20/2016	Heavy Snow
Monroe County	03/09/2001	Heavy Snow			

Table 46 - Monroe County Ice Storm History (NOAA, NCEI, 2020)

Monroe County Ice Storm History (NOAA, NCEI, 2020)		
Location	**Date**	**Event**
Monroe County	01/02/1996	Ice Storm
Monroe County	11/13/1997	Ice Storm
Monroe County	12/11/2002	Ice Storm
Monroe County	02/05/2004	Ice Storm
Monroe County	03/16/2004	Ice Storm
Monroe County	01/22/2005	Ice Storm
Monroe County	12/15/2005	Ice Storm
Monroe County	01/27/2009	Ice Storm
Monroe County	01/31/2011	Ice Storm
Monroe County	02/01/2011	Ice Storm
Monroe County	12/17/2016	Ice Storm

4.3.10.4 Future Occurrence

There is a high probability of winter weather and winter storms occurring in Monroe County, with expected annual events across most of the Commonwealth. The county is located in an area with the chance of equaling or exceeding total snow depths of 30 to 50 inches. An analysis of the past occurrences indicates that this trend will continue annually in the future. Meanwhile, climate change is expected to bring changes to the future of winter storms impacting Pennsylvania. Climate scientists believe that extreme winter storms are expected to occur more frequently – there have been about twice as many extreme snow events in the United States in the latter half of the 20th century as occurred in the first half. This uptick is caused in part by higher-than-normal ocean surface temperatures that result in an increased source of moisture for storms that

develop over the Atlantic Ocean. Conditions for severe winter storms are particularly heightened in the eastern United States due to changes in atmospheric circulation patterns caused by higher temperatures and melting Arctic sea ice. Winters in 2000 and 2001 were mild in Pennsylvania and led to spring-like thunderstorms during the winter months rather than snowstorms. Such thunderstorms can be followed by cold fronts and winter storms resulting in temperature drops of 50˚F in a few short hours. Even though average temperatures are expected to be higher overall and there are expected to be fewer extreme cold days, those that do occur are expected to reach record-setting low temperatures more frequently. Winter storms are a regular, annual occurrence in Monroe County and should be considered highly likely. Approximately thirty-five winter storm events occur across Pennsylvania annually and about three are estimated to impact Monroe County each year.

4.3.10.5 Vulnerability Assessment

Winter storms are a concern based on frequency of winter storm effects on Monroe County. Based on the information available, all communities in Monroe County are essentially equally vulnerable to the direct impacts of winter storms. Residents of the more rural areas of the county may be more susceptible to the vulnerability of delayed emergency medical assistance. Additionally, residents of the mountainous areas of the county may also be more susceptible during severe storms, especially when medical assistance is needed.

Because of the frequency of winter storms, there have been various developed strategies to respond to these events. Snow removal and utility repair equipment is available to respond to typical events. The use of auxiliary heat and electricity supplies such as wood burning stoves, kerosene heaters and gasoline power generators reduce the vulnerability of humans to extreme cold temperatures commonly associated with winter storms but can increase their vulnerability to other hazards. People residing in structures lacking adequate equipment to protect against cold temperatures or significant snow and ice are more vulnerable to winter storm events. Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large number of traffic accidents, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems. This weather has had the ability to close businesses, close schools and block and damage roadways throughout the county. The main transportation routes in the county (Interstates 80 and 380, U.S. Route 209, and State Routes 33, 115, 191, 196, 314, 390, 402, 423, 447, 534, 611, 715, 903, 940) are normally opened immediately for emergency traffic, but secondary roads can remain impassable for days. Most residents and travelers in Monroe County are aware of winter weather announcements and avoid travel when under a winter storm watch.

Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large

number of traffic accidents, strand motorists due to snow drifts, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems. Similar to the vulnerability assessment discussion for tornadoes and severe wind, vulnerability to the effects of winter storms on buildings is also dependent on the age and type of the building, construction material used, and condition of the structure. Additional information on construction type and building codes enforced at time of construction would allow a more thorough assessment of the vulnerability of structures to winter storm impacts such as severe wind and heavy snow loading. With Monroe County specifically, data of housing units have been compiled from 1939 to present times. The majority of housing units were built in the years 1980 – 1989 with a total of 19,461 houses built (23.8% of houses in Monroe County). Since majority of houses in Monroe County were not built recently, there is a great amount of vulnerability with not only the structures themselves but the residents/families that live inside. The houses built and families inside the older built homes are more vulnerable to winter storms compared to ones that were recently built. *Table 47 - Year Housing Units Built in Monroe County* evaluates the years houses were built within the county.

Table 47 - Year Housing Units Built in Monroe County

Year Housing Units Built in Monroe County (US Census, 2020)		
Year	**Number of Housing Units Built**	**Percent of Housing Units Built**
2014 or later	1,298	1.6%
2010 – 2013	923	1.2%
2000 – 2009	13,703	16.7%
1990 – 1999	15,729	19.2%
1980 – 1989	19,461	23.8%
1970 – 1979	10,885	13.3%
1960 – 1969	5,928	7.2%
1950 – 1959	4,229	5.2%
1940 – 1949	2,236	2.7%
1939 or earlier	7,436	9.1%
Total	**81,828**	**100%**

4.3.11. Dam and Levee Failure

4.3.11.1 Location and Extent

Dams

A dam restricts the flow of water or underground streams and often creates reservoirs for water storage. The reservoirs created by these barriers not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use aquaculture, and navigability. Levees are a type of dam feature and are used to prevent water from entering an area that would otherwise be submerged. This allows for reclaiming land for human use in development, or agriculture.

Dam failures most often occur during or after a massive rainfall, flooding, or spring thaws, sometimes with little to no warning. Depending on the size of the water body where the dam is constructed, water contributions may come from distant upstream locations. Water contributions may also come from dam failures in adjoining counties, along the same riverine or water features. A Monroe County dam is shown is *Figure 43 – Leavitt Branch Flood Control Dam.*

Figure 43 - Leavitt Branch Flood Control Dam

Image Provided by Monroe County OEM.

The National Inventory of Dams (NID) is a registry that captures information about structures that are greater than or equal to 25 feet in height or that impound 50-acre-feet or more of water (an acre-foot is equal to 325,851 gallons of water); it includes structures above 6 feet in height, where failure would potentially cause damage downstream. The dams are classified in terms of hazard potential as "High, "Significant", or "Low," with high-hazard dams requiring emergency action plans (EAPs). As listed in the table below, there are seventy-seven dams in Monroe County registered with the U.S. Army Corps of Engineers in the NID. According to the NID, there are fifty-one dams that have emergency action plans (EAPs). There are three dams within the county that have no emergency action plan, and two of these dams are identified as high-hazard dams by the National Inventory of Dams. *Table 48 - Monroe County Dam Inventory* illustrates the dams located in Monroe County. There are forty-three dams that are identified as high-hazard dams, twenty-one dams that are identified as low-hazard dams, eleven dams that are identified as significant-hazard dams, and two dams that are identified as unknown status with regard to hazards.

Table 48 - Monroe County Dam Inventory

Monroe County Dam Inventory (NID 2021)						
Dam Name	**River**	**Owner Name**	**Year Completed**	**Drain Area**	**Hazard**	**EAP**
Alpine Lake	TR Butz Run	Alpine Lake Lot Owners Assoc. INC.	1962	0.6	L	NR
Analomink Lake	TR Brodhead Creek	Analomink Rod & Gun Club, INC.	1910	1.3	S	Y
Arrowhead Lake	Trout Creek	Arrowhead Lake Community Assoc. INC.	1954	14.74	H	Y
Blue Mountain Lake	TR Brodhead Creek	Blue Mountain Lake Assoc.	1908	1.1	H	Y
Bradys Lake	TR Trout Creek	PA Game Commission	2007	7.49	H	Y
Brier Crest Woods	TR Tunkhannock Creek	Brier Crest Woods Property Owners Assoc.	1973	0.5	H	Y
Browns Lake	Stony Run	Carl & Holly Martin	1925	2.4	H	Y

Dam Name	River	Owner Name	Year Completed	Drain Area	Hazard	EAP
Crawford Lake	Paradise Creek	Paradise Falls Lutheran Assoc.	1938	13	H	Y
Crescent Lake	Pocono Creek	Crescent Lake Assoc.	1957	0.54	L	NR
Dormoy Lake	TR Stony Run	Daniel W. Keuler	1930	0.14	U	NR
East Stroudsburg	Sambo Creek	Borough of East Stroudsburg	1936	1.68	H	Y
Easton Anglers	Wilkenson Run	Easton Anglers Assoc.	1929	1.6	L	NR
El-Do Lake	TR Dotters Creek	El Do Lake Property Owners Assoc. INC.		0.27	H	Y
Flagler	Flagler Run	Olde Mill Run Property Owners Assoc.	1915	1.6	L	NR
Goose Pond Run (PA-464)	Goose Pond Run	Monroe County Commissioners	1975	6.8	H	Y
Gregory Pond	Zacharias Run	Borough of East Stroudsburg	1922	14	L	NR
Grubers Lake	Appenzell Creek	Carlos R. Gruber	1928	4	L	NR
Hallowood Acres	Leas Creek	Hallowood Acres Homes Assoc.	1970	1.07	H	Y
Hemlock Lake	TR Pohopoco Creek	Hemlock Lake P.O.A.	1950	0.48	H	Y
Hidden Lake Dam		DOI NPS	1928		S	Y
Hunter Lake	Rocky Run	Golden Slipper Club Camp	1928	2.1	S	Y
Indian Mountain Lake	Mud Run	Indian Mountain Lake Civic Assoc.	1960	2.7	H	Y
Lake Akiba	TR Appenzell Creek	Akiba CA, LP	1926	3.4	H	Y
Lake Lenape	Goose Pond Run	Camp Canadesis, INC.	1901	4.1	L	NR
Lake Minausin	Swiftwater Creek	Pocono Manor, INC.	1903	3.4	L	NR

Dam Name	River	Owner Name	Year Completed	Drain Area	Hazard	EAP
Lake Naomi	Upper Tunkhannock Creek	Lake Naomi Club	1895	19.5	H	Y
Lake Sinca	TR Two Mile Run	Green Wood Acres P.O.A.	1969	0.45	H	Y
Lake Swiftwater	Swiftwater Creek	Lake Swiftwater Club, INC.	1930	9.68	H	Y
Lake Trexler	Middle Creek	Boy Scouts of America	1962	1.9	L	NR
Lake Watawah	Lake Creek	George Leshanski	1922	3.8	L	NR
Lakeview Pond	TR Bushkill Creek	Theresa's Lakeview Bar & Grill	1975	0.4	S	Y
Leavitt Branch (PA-463)	Leavitt Branch Brodhead Creek	Monroe County Commissioners	1976	6.52	H	Y
Lenape Lake	Spring Run	Camp Pinemere	1927	0.5	L	NR
Lindenmere	TR Pocono Creek	Camp Lindenmere, INC.	1935	0.49	S	Y
Locust Lake	TR Trout Creek	Locust Lake Village Property Owners Assoc.		0.42	H	Y
Lower	Sambo Creek	Borough of East Stroudsburg	1921	3	L	NR
Lower Lake	Leavitt Branch Brodhead Creek	Skytop Lodge, INC.	1923	5	L	NR
Manzanedo	Stone Mountain Run	Manzanedo Rod & Gun Club	1914	0.5	L	NR
Marshall Lake	Pond Creek	Khan F. Mohammad	1904	7.88	H	Y
Meadow Lake	TR Pond Creek	Meadow Lake Fishing Club	1916	4.3	S	Y
Middle	Sambo Creek	Borough of East Stroudsburg	1922	2.7	H	Y
Monroe Lake	Bear Swamp Run	Monroe Lake P.O.A.	1926	1.1	H	Y
Mount Airy	Forest Hills Run	Mt. Airy Casino Resort	1974	2.57	H	Y

Dam Name	River	Owner Name	Year Completed	Drain Area	Hazard	EAP
Mountain Springs Dike	Appenzell Creek	Jack B. Rader	1919	2.6	U	NR
Mountain Springs Lake	Appenzell Creek	Jack B. Rader	1919	2.6	H	Y
Mountaintop Lake #1	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1993	1.02	H	Y
Mountaintop Lake #2	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1993	1.02	H	Y
Naus and Newlyn	Dresser Run	Pocono Country Place Assoc.	1968	1.82	L	NR
NO 1	Tobyhanna Creek	Miss Hitt Marilou Etal		13.9	L	NR
North Arrowhead Lake	TR Trout Creek	Arrowhead Lake Community Assoc. INC.	1971	1	H	Y
Pinecrest Lake (Tamaque Lake)	Beaver Creek	Pine Crest Lake Community Trust	1927	1.88	H	Y
Pinetree Lake	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1972	1.5	H	Y
Pleasant Valley Estates	TR Jonas Creek	Pleasant Valley Estates Civic Assoc.	2009	0.43	H	Y
Pocahontas	TR Brodhead Creek	Pocahontas Rod & Gun Club	1911	0.41	H	Y
Pocono Highlands	TR Pond Creek	JNS Holdings	1928	1.1	H	Y
Pocono Lake	Tobyhanna Creek	Pocono Lake Preserve	1957	75	S	Y
Pocono Laurel Lake	TR Pocono Creek	Pocono Laurel Lake, P.O.A.		0.38	S	N
Robert Christman	TR Brodhead Creek	Robert L. Christman, II		0.5	H	N
Shawnee Lake	Shawnee Creek	Shawnee Development, INC.	1927	3.8	H	Y
Shawnee Pond	Shawnee Creek	Ski Shawnee, INC.	2008	2.47	S	Y
Skytop	Leavitt Branch Brodhead Creek	Skytop Lodge, INC.	1930	5.7	H	Y

Dam Name	River	Owner Name	Year Completed	Drain Area	Hazard	EAP
Spring Lake	TR Brodhead Creek	Spring Lake Homeowners Assoc.	1983	0.17	H	Y
Springwater Lake	TR Sambo Creek	Twin Lake Estates P.O.A. INC.	2009	0.22	H	Y
Stillwater Lake	Upper Tunkhannock Creek	BSA Minsi Trail Council	1900	13.3	H	Y
Stony Garden Reservoir	Ross Common Creek	PA American Water Company	1912	1.8	L	NR
Summit Lake No. 1	Red Run	Stillwater Lake Civic Assoc. INC.	1919	0.9	S	Y
Summit Lake No. 2	Red Run	Delaware Lackawanna Railroad Co. INC.	1919	0.7	L	NR
Sun Mountain Lake	Shawnee Creek	Shawnee Development, INC.	1934	3.62	H	Y
Sweetwater Lake	TR Sambo Creek	Twin Lake Estates P.O.A. INC.	1983		H	N
Thomas	TR Stony Run	Marcia M. Thomas	1982	0.69	S	Y
Tobyhanna No. 2	Tobyhanna Creek	DCNR	1951	8.76	H	Y
Werrys Lake	TR Sand Hill Creek	Lake of the Pines Community Assoc. INC. Management Agent	1929	0.4	L	NR
White Heron	Newton Creek	White Heron Lake, INC.	1930	0.72	H	Y
Wigwam Lake	Wigwam Run	Wigwam Lake Club, INC.	1928	1.5	H	Y
Witmer	Cherry Creek	Eastwood Farm	1941	1.1	L	NR
Wolf Swamp Run	Wolf Swamp Run	PA Game Commission		0.98	L	NR

The Pennsylvania Department of Environmental Protection (PA DEP) defines a high-hazard dam as “Any dam so located as to endanger populated areas downstream by its failure”. High-hazard

dams receive two inspections each year – once by a professional engineer on behalf of the owner and once by a PA DEP inspector (DEP 2008).

Levees

Levee failures have the potential to place large numbers of people and properties at risk. Unlike dams, levees are built parallel to a river or another body of water to protect the population and structures behind it from risks of damage during a flooding event. Levees do not serve a purpose beyond flood protection, unlike dams, which can serve to store water or generate energy in addition to protect areas from flooding. The National Levee Database (NLD), like its counterpart of the National Inventory of Dams (NID), is maintained by the U.S. Army Corps of Engineers (USACE) and tracks levees across the United States. Monroe County is home to three levees, which are detailed in *Table 49 – Monroe County Levee Inventory.*

Table 49 - Monroe County Levee Inventory

Monroe County Levee Inventory (National Levee Database, 2021)					
Name	**Levee Type**	**Levee Length (miles)**	**Levee Area (square miles)**	**Sponsor**	**FEMA Accreditation Rating**
East Stroudsburg-Downstream	Earthen Embankment	0.55	0.075	East Stroudsburg Borough	NALS
East Stroudsburg-Upstream	Earthen Embankment	1.22	0.16	East Stroudsburg Borough	NALS
Stroudsburg	Earthen Embankment	1.28	0.16	Stroudsburg Borough	NALS

4.3.11.2 Range of Magnitude

Dams

Dam failures can pose a serious threat to communities located downstream form major dams. The impact of a dam failure is dependent on the volume of water impounded by the dam and the amount of population or assets located downstream. Catastrophic failures are characterized by the sudden, rapid, and uncontrolled release of impounded water from a dammed impoundment or water body. *Table 48 – Monroe County Dam Inventory* shows the locations of dams within Monroe County.

Dam failures may or may not leave enough time for the evacuation of people and property, depending on their abruptness. Seepages in earth dams usually develop gradually, and if the embankment damage is detected early, downhill residents have at least a few hours or days to evacuate. Failures of concrete or masonry dams tend to occur suddenly, sending a wall of water and debris down the valley quickly. Dam failures due to overtopping of a dam normally give sufficient lead time for evacuation.

Levees

Levee failures can be caused by a number of factors, and they can also cause catastrophic effects. Damage to the area beyond a levee, if it fails, could be more significant than if the levee was not present. Levees are designed to provide a specific level of protection, so flooding events could overtop the levees if these events exceed the levee specifications. Additionally, levees can also fail if they are allowed to deteriorate or decay. Regular maintenance of levees is critical. *Figure 46 – Monroe County Levee Locations* illustrates areas protected by the Monroe County levee systems.

A levee failure or breach causes flooding in landward areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating, depending on the level of flooding for which the structure is designed and the amount of landward development present. Large volumes of water may be moving at high velocities, potentially causing severe damage to buildings, infrastructure, trees, and other large objects. Levee failures are generally worse when they occur abruptly with little warning and result in deep, fast-moving water through highly developed areas.

4.3.11.3 Past Occurrence

Dams

There have been no occurrences of dam failure or major incidence occurring at the locations of dams in Monroe County. Smaller incidences have occurred but have not had significant impacts in the county.

Levees

The National Levee Database (NLD) lists no occurrences of failure or major incidents involving Monroe County levees, such as the one seen in *Figure 44 – Stormwater Flowing Through a Monroe County Levee*.

Figure 44 - Stormwater Flowing Through a Monroe County Levee

Image Provided by Monroe County OEM.

4.3.11.4 Future Occurrence

Dams

Although dam failures can occur at any time, given the right circumstances, the likelihood of a dam failure in Monroe County is considered to be unlikely.

The presence of structural integrity and inspection programs significantly reduces the potential for major dam failure events to occur. The PA DEP inventories and regulates all the dams that meet or exceed the following criteria (PA DEP, 2008):

- Impound water from a drainage area of greater than 100 acres
- Have a maximum water depth greater than 15 feet
- Have a maximum storage capacity of 50 acre-feet or greater

The construction, operation, maintenance, and abandonment of dams is reviewed and monitored by the PA DEP Division of Dam Safety. Dams are evaluated based on categories such as slope stability, undermining seepage, and spillway adequacy.

Levees

Although levee failures can occur at any given time, given the right circumstances, the future occurrence of levee failures in Monroe County can be considered unlikely. Most levees are designed to meet a specified level of flooding. While FEMA focuses on mapping levees that will reduce the risk of a 1% annual chance flood, other levees may be designed to protect against both smaller and larger floods.

4.3.11.5 Vulnerability Assessment

Property and populations located downstream from any dams or levees are vulnerable to dam failures. The Pennsylvania Code (§105.91 Classification of dams and reservoirs) classifies both dams by size and the amount of loss of life and economic loss expected in a failure event. *Table 50 – Dam Classification* displays the dam classification guide for the Commonwealth of Pennsylvania. Although the size of a dam may result in varying impacts, the hazard potential classification of category one dams is a more important reference indicator, since that will indicate the level of potential substantial loss of life and excessive economic loss.

Table 50 - Dam Classification

Dam Classification (PA CODE 1980)		
Dam Size Classification		
Class	Impoundment Storage (Acre-Feet)	Dam Height (Feet)
A	Equal to or greater than	Equal to or greater than 100
B	Less than 50,000 but greater than 1,000	Less than 100 but greater
C	Equal to or less than 1,000	Equal to or less than 40
Category	Loss of Life	Economic Loss
1	Substantial	Excessive
2	Few	Appreciable
3	None Expected	Minimal

Dams

Dam and levee failures can cause significant environmental effects, as the resulting flood from a dam failure is likely to disperse debris and hazardous materials downstream that can damage

local ecosystems. Debris carried downstream can block roads, cause traffic accidents, disrupt traffic patterns, and delay the delivery of essential services along major traffic corridors. Debris flow can also cause landslides along steep slopes and embankments. The economic and financial impact from damage and recovery ranges from minimal to severe, depending on the magnitude of damage and scale of failure.

Of the forty-three high hazard dams, the Lake Naomi Dam has the largest drainage area with a total drainage area of 19.5 acres. The dams that were constructed most recently are the Springwater Lake Dam and the Pleasant Valley Estates Dam, which were constructed in 2009. The dam that is the oldest in the county is the Lake Naomi Dam which was completed in 1895. The dam with the highest height in the county is the Goose Pond Run (PA-464) Dam with a height of 97 feet. The largest owner of dams in Monroe County is East Stroudsburg Borough which owns four dams in the area of East Stroudsburg. The dams owned by East Stroudsburg Borough are the East Stroudsburg, Gregory Pond, Middle, and Lower Dams. A majority of the dams in Monroe County are owned by small municipalities, different state agencies, local individuals, and corporations. The county dams are also distributed evenly throughout the counties and the municipalities, with an even mix of high and low hazard dams in each municipality.

Levees

There are a large number of critical infrastructure and functional needs facilities within the levee protection area for the levees around Monroe County. The National Levee Database assists in calculating the estimated value of structures that are located behind each levee. The East Stroudsburg Upstream and Downstream leveed areas have a building value that is estimated at $152,559,949. The Stroudsburg leveed area has a building value of approximately $137,541,730. *Table 51 – Number of Vulnerable Structures within Leveed Areas* shows the number of addressable structures, critical infrastructure facilities, and functional needs facilities in the levee protection area. The features included in the tables will be particularly vulnerable to levee failure because they are protected by the system. Should the levee protection system fail, the outlined facilities would be vulnerable to flooding.

Table 51 - Number of Vulnerable Structures within Leveed Areas

Structures Within Leveed Areas	
Levee Area Name:	**Addressable Structures in Levee Area:**
East Stroudsburg-Downstream	51
East Stroudsburg-Upstream	372
Stroudsburg	398
Totals:	**821**

Levee Area Name:	Critical Infrastructure in Levee Area:
East Stroudsburg-Downstream	0
East Stroudsburg-Upstream	1
Stroudsburg	1
Totals:	**2**
Levee Area Name:	**Functional Needs in Levee Area:**
East Stroudsburg-Downstream	0
East Stroudsburg-Upstream	0
Stroudsburg	1
Totals:	**1**

Figure 45 - Monroe County Dams

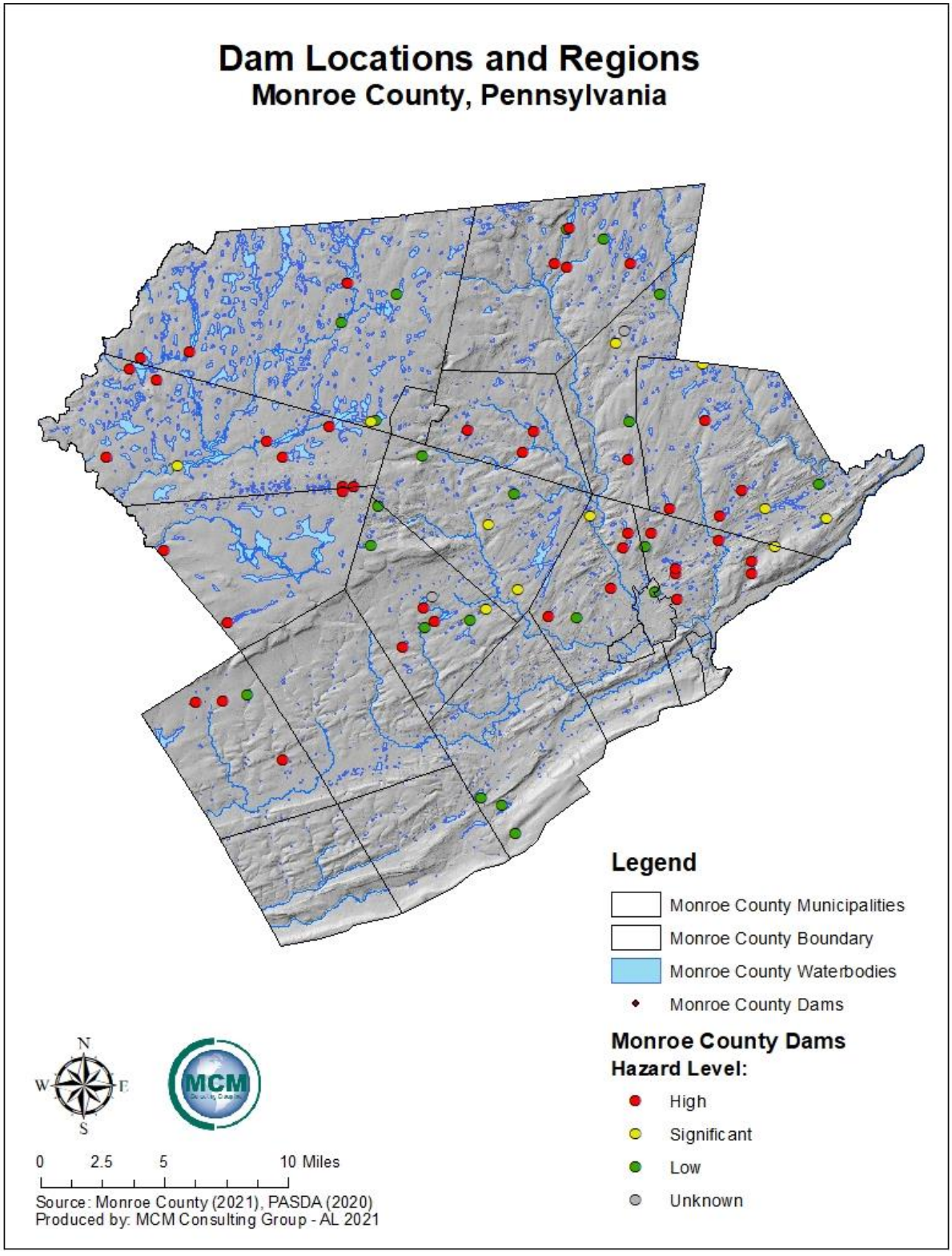
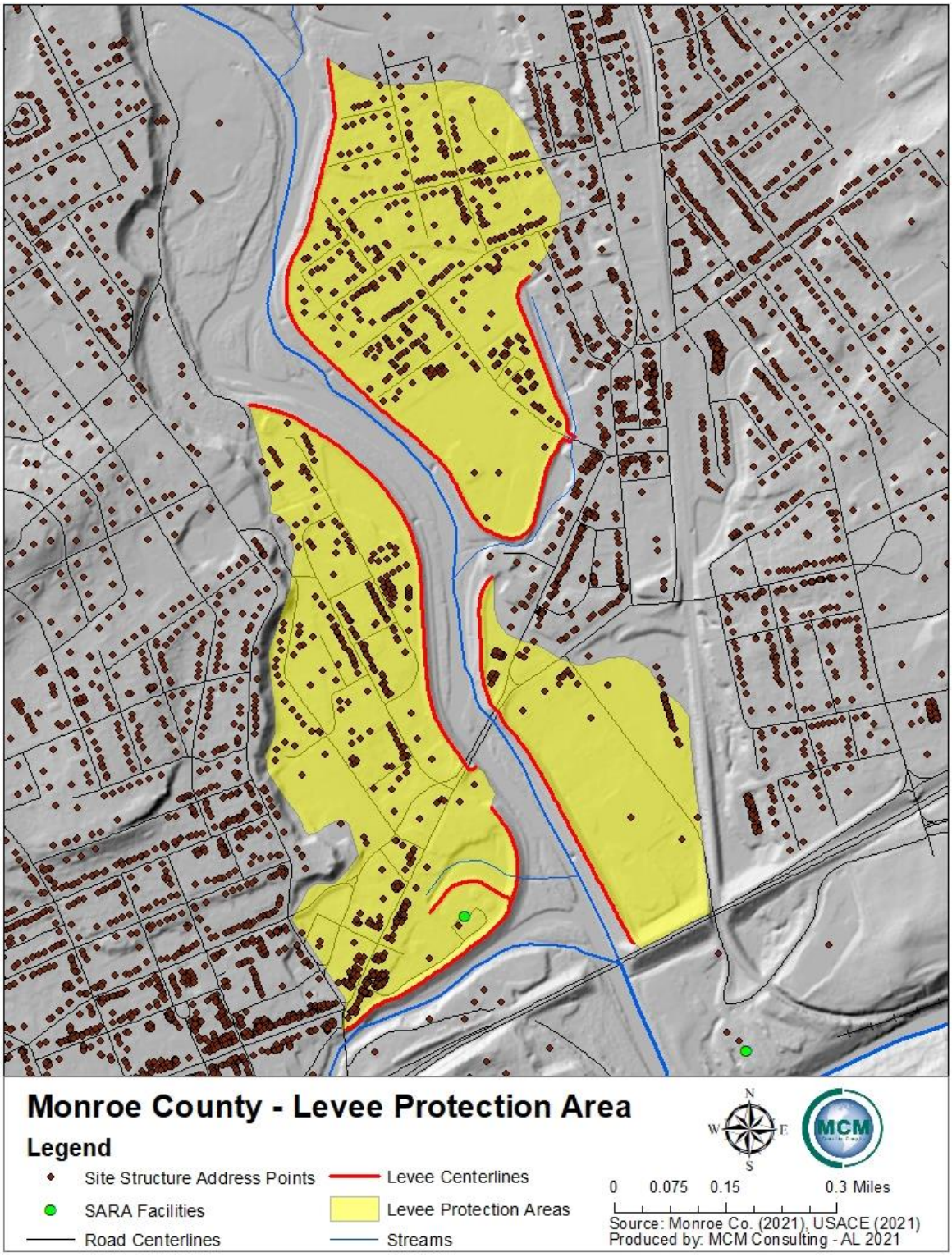


Figure 46 - Monroe County Levee Locations



4.3.12. Disorientation

4.3.12.1 Location and Extent

Disorientation is the loss of one's sense of direction, position, or relationship with one's surroundings. This can be defined as mental confusion or impaired awareness. Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. This report also identifies water rescue as persons can become disoriented or lost in small watercraft and while swimming. Search and rescue efforts are focused in and around state forest and state park lands (DCNR 2009).

Most municipalities in Monroe County have had lost persons incidents, however disorientation is most likely to occur in areas of vast, open wilderness. The majority of Monroe County's land is undeveloped, with large portions being forested and remote. There are over 500 miles of hiking and biking trails in Monroe County, with most of these trails running through heavily forested areas. Each year, several people become lost or disoriented in wilderness areas throughout the county.

A wide variety of factors can contribute to the outcome of a search and rescue mission, but the most common dangers associated with disorientation are lack of food, water, and shelter. Monroe County generally has an abundance of water and during summer months, and shelter is less of a necessity than during the winter months when extreme low temperatures can pose a larger threat. Age, physical fitness, and familiarity with the area can also have a bearing on the outcome. All ranges of population, from age to social status, would have a vulnerability to disorientation.

4.3.12.2 Range of Magnitude

Monroe County has a total of 617 square miles. Of the 617 square miles, approximately 608 square miles are land while 9 square miles are water. The major waterways within Monroe County are the Lehigh River, the Delaware River, and the tributaries that are associated with each river. Each year, several people become lost in Monroe County's wilderness areas. Wilderness search and rescue requires considerable resources. Responses often result in the use of extensive man-hours and resources.

4.3.12.3 Past Occurrences

Wilderness search and rescue has required considerable resources, sometimes resulting in the expenditure of considerable resources mentioned above. Monroe County does not have exact numbers and dates for past disorientation occurrences. According to Knowledge Center statistics for various counties in the Commonwealth of Pennsylvania, there are approximately two

disorientation incidents per year in Monroe County. The incidents are either lost/disoriented, escape, or suicide related. The last disorientation event for Monroe County that resulted in a missing persons situation was documented on April 5th, 2021. *Table 52 – Past Missing Person Events* illustrates the number and dates of past reported missing persons events in Monroe County. This represents an estimation of disorientation events.

Table 52 - Past Missing Person Events

Past Missing Persons Events (Knowledge Center, 2021)		
Event Name:	**Event Location:**	**Event Date:**
Missing Person	Middle Smithfield Township	07/13/2009
Missing Person	Coolbaugh Township	07/20/2010
Injured Hunter	Paradise Township	10/02/2010
Missing Person	Hamilton Township	10/23/2010
Missing Person	Stroud Township	06/08/2011
Lost Hikers	Tobyhanna Township	06/17/2011
Missing Juvenile	-	10/18/2011
Missing Person	Jackson Township	04/23/2012
Lost Hikers	Stroud Township	09/24/2012
Missing Person	Middle Smithfield Township	02/26/2013
Missing Person	Stroud Township	07/12/2013
Lost Hikers	Coolbaugh Township	11/23/2013
Missing Child	Chestnuthill Township	04/28/2015
Missing Person	Tunkhannock Township	05/21/2015
Missing Person	Stroud Township	06/02/2015
Missing Person	Polk Township	06/13/2015
Missing Person	Barrett Township	07/05/2015
Missing Juvenile	Stroud Township	11/17/2015
Missing Juvenile	Middle Smithfield Township	05/04/2017
Missing Person	Stroud Township	06/15/2017
Missing Person	-	12/27/2018
Missing Person	Coolbaugh Township	04/05/2021

4.3.12.4 Future Occurrence

During the warm summer months, as activities such as hiking, biking, and camping increase, so does the likelihood of individuals becoming disoriented. November also has several search and rescue events due to lost hunters during the annual hunting season. Disorientation events are most likely to occur in state parks and state forests where outdoor recreation is most abundant,

and the forest is most dense. Medical emergencies occur regularly in the county, especially with the elderly, which could result in disorientation.

4.3.12.5 Vulnerability Assessment

Individuals are most likely to become disoriented in vast, open wilderness. Children and the elderly are more vulnerable to exposure of the elements. The elderly tend to be more vulnerable to disorientation often due to medically related issues. Many times, an individual with dementia or Alzheimer's Disease will become disoriented in wilderness or residential areas.

The most dangerous period to become lost and disoriented outdoors is during the winter months when heat and shelter are vital. Monroe County regularly experiences winter storms and temperatures below freezing, so individuals participating in outdoor recreational activities in the winter are at a higher risk of injury or illness due to disorientation. A majority of the county is forested and relatively rural, and *Figure 47 – Disorientation Vulnerability for Monroe County* identifies areas within the county where disorientation is most likely to occur, such as state parks, state forest, and state game lands. Also, vulnerability in Monroe County is associated with numerous waterways that run through the county, which are illustrated in *Figure 47 – Disorientation Vulnerability for Monroe County*. There are several hiking and biking trails in Monroe County. These trails are likely to be the focus of search and rescue operations should a person go missing. *Figure 48 – Monroe County Hiking and Biking Trails* illustrates these trails and their location.

Figure 47 - Disorientation Vulnerability for Monroe County

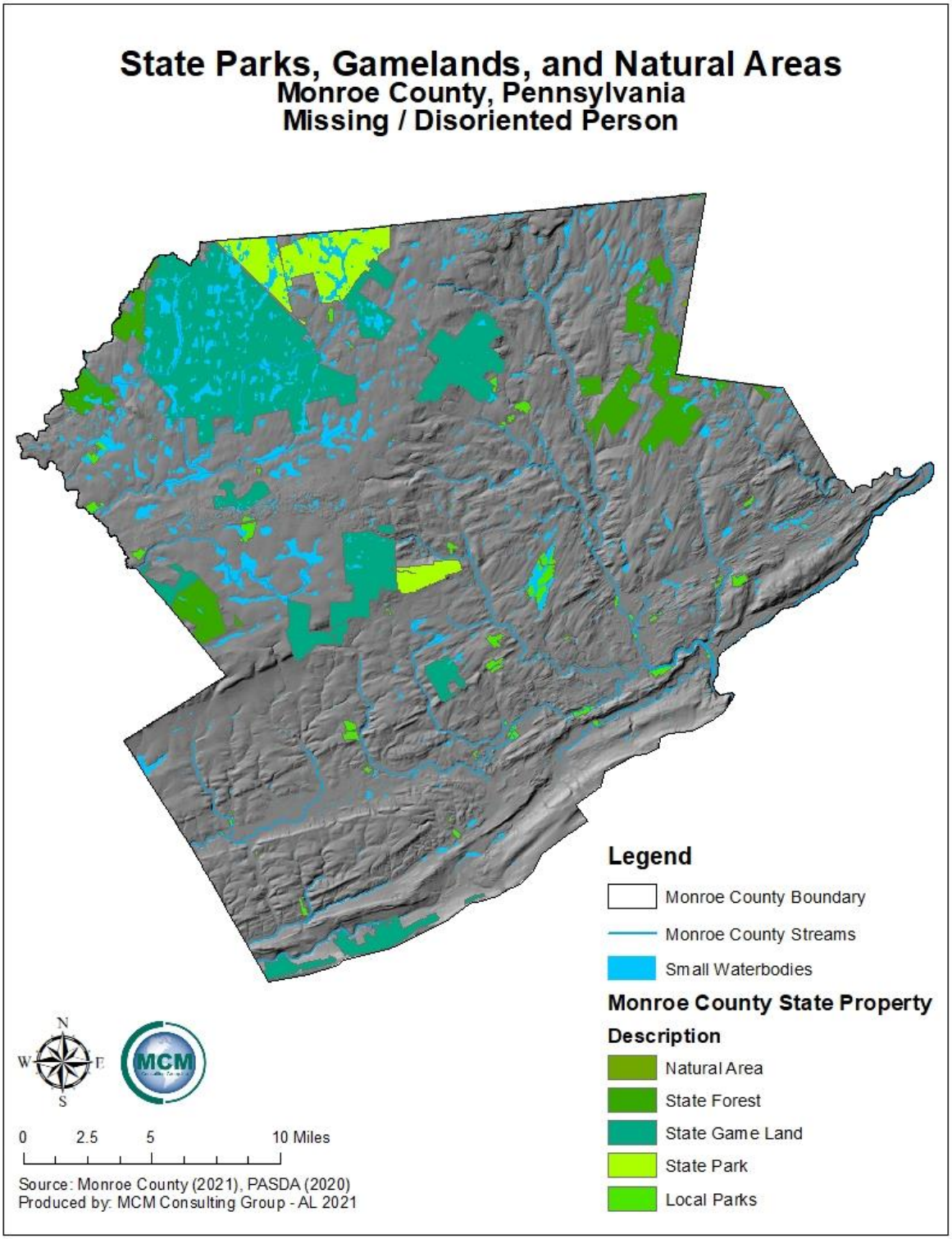
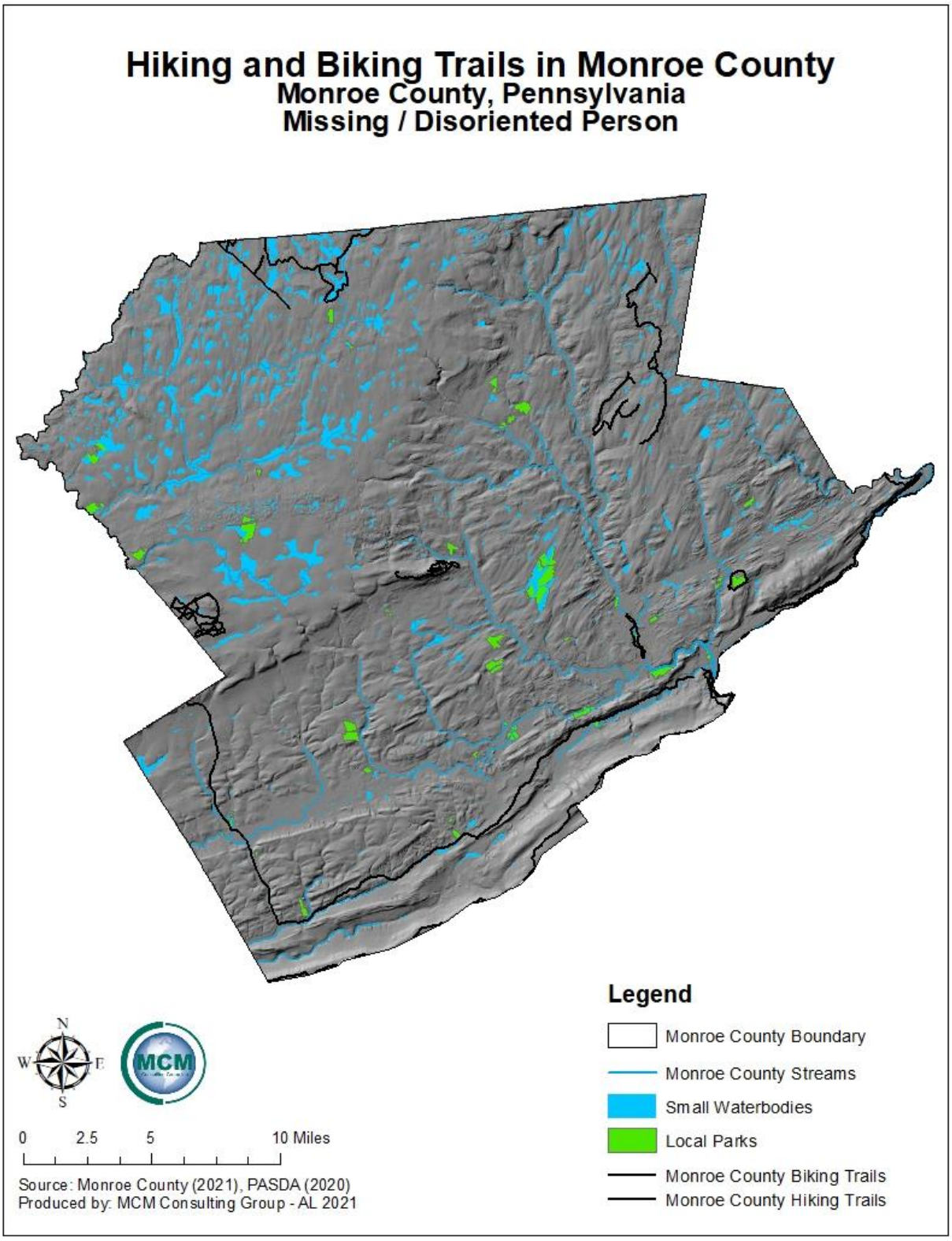


Figure 48 - Monroe County Hiking and Biking Trails



4.3.13. Drowning

4.3.13.1 Location and Extent

Drowning can be a significant hazard in communities with bodies of water (e.g., ponds, lakes, rivers, etc.) and extensive outdoor recreational activities. Monroe County has grown, and continues to grow in popularity as a tourist destination. Water related recreational opportunities such as fishing, boating, and swimming are popular among residents and visitors. Some of the most popular tourist destinations in the county are the Stillwater Lake, Lake Naomi, Pocono Lake, Bradys Lake, Beltzville Lake, and the Delaware River, specifically in the Delaware Water Gap area. Other rivers, lakes, and ponds are spread throughout the county.

In addition to natural bodies of water, swimming pools are another location where drownings occur. Many swimming pools are located at residences and hotel/lodges throughout the county. Drownings can also be caused due to flooding events; this hazard is discussed further in Section 4.3.4. of this plan.

4.3.13.2 Range of Magnitude

Drownings can result in death due to the lungs filling with water and not allowing the transfer of oxygen to the body. Drowning rates are particularly high for children ages 1-19. According to the Center for Disease Control (CDC) 2021, from 2005-2014, there were about ten deaths per day in the United States due to unintentional drownings (non-boating related). An additional 332 people die each year from drowning in boating-related incidents. The CDC also reports that about one in five people who die from drowning are children 14-years of age and younger. And, for every child who dies from drowning, another five receive emergency department care for nonfatal submersion injuries. Of those that are treated in emergency departments for submersion injuries more than 50% require hospitalization or transfer for further care. Nonfatal submersion injuries can cause severe brain damage that may result in long-term disabilities such as memory problems, learning disabilities, and permanent loss of basic functioning. The World Health Organization (WHO) reports that more than forty people die by drowning every hour of every day. They also report that drowning is one of the top ten leading causes of death for children in every region of the world.

4.3.13.3 Past Occurrence

Record of past occurrences of drowning were difficult to identify due to insufficient available data. *Table 53 – Drownings in Monroe County 2013 - January 31, 2021* identifies incidents of drowning, near drowning, and water rescues in Monroe County from 2013 to 2020 as identified from Corvena (formerly known as Knowledge Center).

Table 53 - Drownings in Monroe County 2013 - January 31, 2021

Drownings in Monroe County 2013 to January 31, 2021		
Date	**Event**	**Location**
07/04/2013	Drowning in a pool	East Stroudsburg
07/23/2013	Drowning in Broadhead Creek	Monroe County
07/16/2014	Personal care home resident drowning in a nearby lake	Stroud Township
07/23/2014	Drowning in a pool at Days Inn	Smithfield Township
05/29/2015	Near drowning at lodge	Grey Wolf Lodge, Scotrun
08/18/2015	Drowning in the Delaware River	Delaware Water Gap
07/16/2017	Water rescue, canoe capsized. Body recovered.	Middle Smithfield Township
07/01/2018	Drowning, water rescue of 12-year-old at Stillwater Lake	Coolbaugh Township
07/02/2018	Drowning/body recovery at Mountain Spring Lake	Jackson Township
05/23/2019	Water rescue of two people in the water. One civilian and three police officers transported for injuries sustained during the rescue.	Stroudsburg Borough
08/06/2019	Water rescue at Arrowhead Lake for a female in distress. The victim was transported to the hospital.	Tobyhanna Township
07/19/2020	Drowning of a 4-year-old in a pool. The victim was transported to the hospital and the county coroner was requested.	Middle Smithfield Township
08/04/2020	Water rescue of three individuals trapped under the South 7th Street Bridge.	Stroudsburg Borough
01/13/2021	A small child fell through the ice, was rescued, and transported to the hospital	Stroud Township

4.3.13.4 Future Occurrence

It is impossible to predict when and where a drowning may occur. During the warm summer months, as activities such as swimming, boating, and fishing increase so does the likelihood of drowning. Based on past occurrences, Monroe County can expect several drownings each year.

4.3.13.5 Vulnerability Assessment

As tourism continues to increase in the county and the number of visitors grows, drowning is likely to continue without mitigation actions in place. Natural water sources like rivers, streams,

lakes, and ponds are identified as vulnerable locations. In addition to natural water sources, man-made water sources such as pools pose a high vulnerability to visitors and residents of the county.

With tourism extremely high in Monroe County, it is anticipated that drownings will continue at pools and natural water sources. Pools with no supervision or lifeguards create a higher vulnerability than ones that are supervised. Children and the elderly are at a higher vulnerability than all other age groups. Natural water sources located in federal and state parks are more vulnerable than natural water sources located in remote areas. In general, all water sources (natural and man-made) in Monroe County create some level of vulnerability to the residents and visitors of the county. *Figure 49 – Drowning Hazards – Water Features* reflects the vulnerability for drowning in Monroe County.

The WHO has identified ten actions created by high-income countries to reduce their drowning burden:

1. Install barriers controlling access to water.
2. Provide safe places away from water for pre-school children, with capable childcare.
3. Teach school-age children basic swimming, water safety and safe rescue skills.
4. Train bystanders in safe rescue and resuscitation.
5. Strengthen public awareness of drowning and highlight the vulnerability of children.
6. Set and enforce safe boating, shipping, and ferry regulations.
7. Build resilience and manage flood risks and other hazards locally and nationally.
8. Coordinate drowning prevention efforts with those of other sectors and agendas.
9. Develop a national water safety plan.
10. Address priority research questions with well-designed studies.

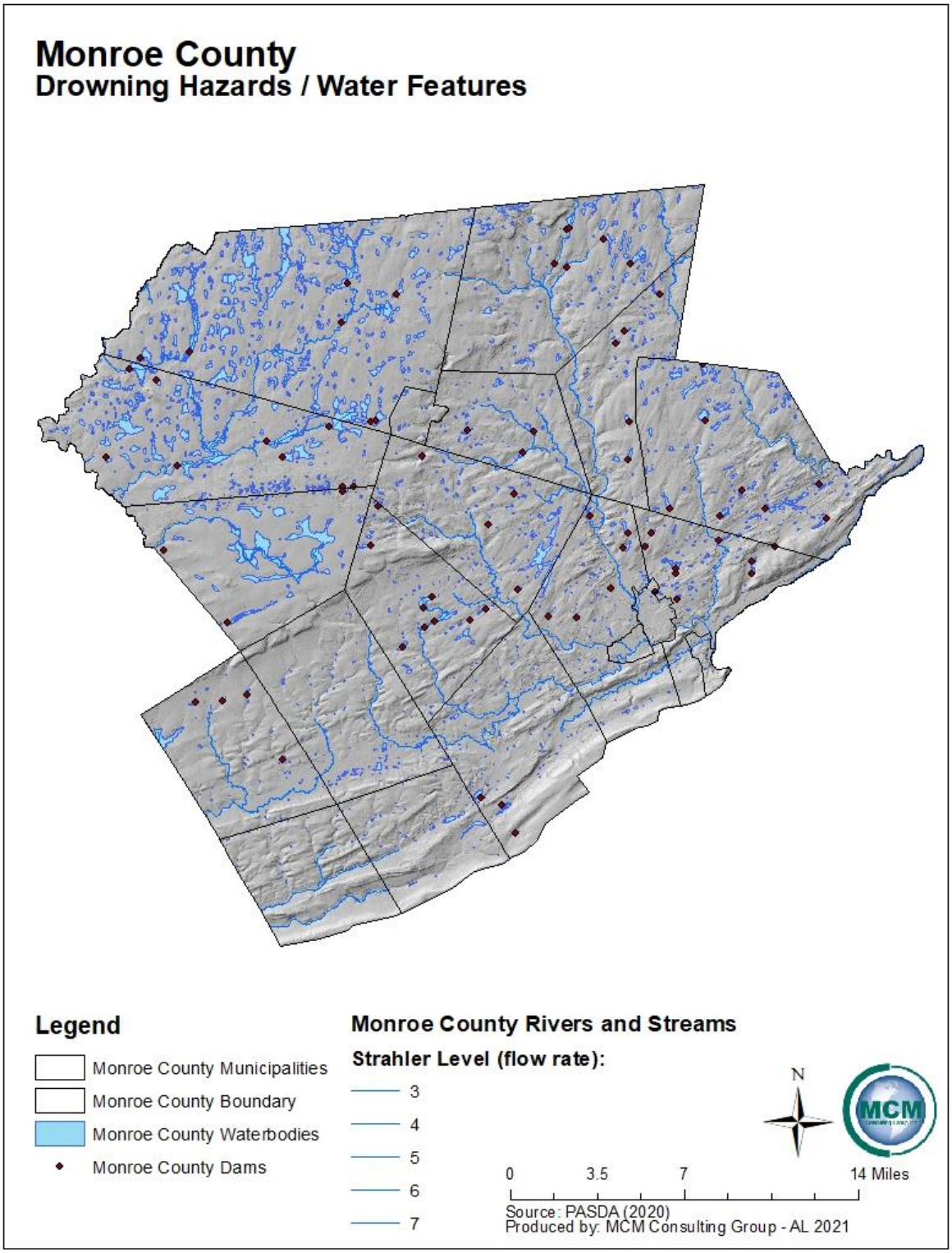
The United States' National Weather Service (NWS) reports that more than half of flood fatalities result from automobiles being swept downstream. In 2003 the NWS started the 'Turn around, don't drown' campaign to help reduce these deaths.

While participating in winter sports such as ice skating, ice fishing, or sledding participants must check the ice layer. Determining the safety of ice can be accomplished by assessing the following factors together:

- Appearance of the ice, its color, texture, and features.
- Thickness of the ice, there are recommended thicknesses for different uses.
- External temperature over a period of time and on the day.
- Snow coverage.
- Depth of water under the ice.
- Size of water body.

- Chemical composition of water, whether water is fresh or salt.
- Local climate fluctuations.
- Extent of ice.

Figure 49 - Drowning Hazards - Water Features



4.3.14. Emergency Services Shortage

4.3.14.1 Location and Extent

Fire, emergency medical services (EMS), local emergency management coordinators (LEMC), and law enforcement service agencies are defined per municipality in Monroe County. In addition to the local services, the county hosts numerous special teams. Regional and state-wide services are also available.

Most areas are served by volunteers instead of career personnel, which adds to the response time due to volunteer availability. Volunteers provide emergency services above and beyond their regular means of financial support and time constraints. Agencies struggle with the availability of personnel depending on the time of day and skills/resources needed. The number of responders in general has decreased due to funding issues and retention of personnel.

Additionally, the time and expense of training required for emergency service personnel (volunteers and paid) is another factor in decreasing numbers of volunteers. The initial training for fire, EMS, and law enforcement can take several months to complete. For those in emergency medical services, there is a regular schedule of continued education to maintain certification. In the fire service, after the initial training, there are specialty courses offered, which are recommended, but not required. For law enforcement, skills such as firearms proficiency must be maintained, and updates to new laws and regulations continues throughout the officer's career.

4.3.14.2 Range of Magnitude

Finances, changing political climates, leadership, or a significant high-profile event can all trigger a system to be declared as "success" or "failure". In some cases, a combination of these factors can create a perfect storm. Unfortunately, many "failed" systems are measured by recent events, no matter how successful they may have been in the past. Although financial problems are often blamed on poor leadership, they have many root causes. Labor rates, benefits, poor productivity, operational design, insurance reimbursements, and market regulation all have a significant direct impact on the financial viability of an organization.

Two fundamental, yet misunderstood, topics are the financial and economic variables that drive emergency service systems. These systems typically generate revenue through tax subsidies, memberships, direct sales, diversification into other lines of business, grants, or fundraising. They spend most of these revenues on direct and indirect labor, and benefits. The remaining dollars go into infrastructure, fuel, medical supplies, insurances, fleet maintenance, dispatch, and other essential items, with hopefully, some left over for recapitalization or fund balance development. Replacing and properly equipping an emergency response vehicle can cost up to and over $1 million.

4.3.14.3 Past Occurrence

There are no official records kept on shortages to emergency services. However, there has been a decrease in the number of new volunteers in the fire service. Most agencies are private organizations that lack local funding and exist based on tax dollars, fundraising, and donations received from their community. The time demand for fundraising adds to the demands on the availability of volunteers. Past practices are not sustaining the needed funds or manpower.

Without financial support from the communities, services may not be able to remain in operation to serve the same communities they have served for decades. Recruitment and personnel retention are keys to success.

4.3.14.4 Future Occurrence

Historically, it has been difficult for small communities to have paid services, therefore requiring volunteers. With fewer volunteers to perform the tasks associated with fire and rescue operations, it is imperative for services to facilitate fundraising. Operational needs are impacted if there are fewer volunteers to raise funds. Without fundraising and community support these fire departments and volunteer EMS agencies will experience broader challenges. Municipalities can help offset some of the financial burdens to their local fire company by imposing a fire tax on its citizens.

The individual volunteer also faces many challenges. Most volunteers must address their own needs by providing for their family and, in many cases, are part of a two-income family. In some cases, they may have multiple jobs to sustain their needs.

Training is essential to provide for the general knowledge and safety of volunteers. Becoming certified as a volunteer firefighter requires hundreds of hours. With the limitation of time, many people find it personally challenging to dedicate time to a volunteer position. Volunteers are becoming less reliable, with many current volunteers getting older and becoming unable to perform at the same levels they once were.

Initially, fire departments were started to handle fires. However, over time when other emergencies occurred, communities called upon the volunteer fire departments to handle various hazards such as vehicle accidents, commercial accidents, flooded basements, wire/trees down, trench rescue, hazardous material spills, traffic control, and sometime event standbys to support other agencies or events.

4.3.14.5 Vulnerability Assessment

The likelihood that EMS agencies and fire services will fail is a concern for all Monroe County communities. Many people within the communities believe that their local fire department is a paid service, and do not necessarily understand the necessity of fundraising.

Law enforcement agencies also have been experiencing personnel shortages. The perception of law enforcement in society changes as events occur. A negative perception of law enforcement can discourage individuals from pursuing a career in law enforcement. Becoming a law enforcement officer requires a commitment of time and finances for training at local, state, or federal levels. The selection of law enforcement officers includes not only physical and mental aptitudes, but also a comprehensive physiological screening.

If any current public service agency fails to provide enough personnel to perform their required duties, then those duties must be provided for by another service agency that may be many miles away. This can put people and property in danger due to the increased response time. Many communities in Pennsylvania have already experienced the closure of services.

It is recommended that each municipality assess their own vulnerabilities by maintaining and building relationships with their local providers to begin to plan accordingly for if a local service were to shut down its operation. The statistics, response times, and all times associated with units dispatched are easily obtainable from the county 911 center. Consolidation of services is not a new concept for addressing the closure of services. Municipalities must weigh all the pros and cons for consolidation of emergency services with neighboring communities.

The emergency services departments in Monroe County must be supported to create and or discover new ways to not only recruit but to retain volunteers. If left unattended, the issue will continue and the lack of response will grow, leaving communities more vulnerable to hazards that can cause loss of life and property, as shown in *Figure 50 – Emergency Services Respond to Local Fires*.

Figure 50 - Emergency Services Respond to Local Fires

Images Provided by Monroe County OEM.

It is would be beneficial for the community to have an understanding of the perpetual needs associated with providing these services. In addition, continued support, and efforts to inform legislature could all prove to be paramount in assuring these services remain in operation into the future. At the time of the writing of this plan, a number of bills had been introduced in both the House of Representatives and the Senate as a result of a two-year study initiated by Senate Resolution 6 (SR6). The final report can be found here: http://pehsc.org/wp-content/uploads/2014/05/SR-6-REPORT-FINAL.pdf.

Emergency response agencies that currently provide services within Monroe County are identified in the following tables, *Table 54 – Monroe County Fire Departments* identifies the municipalities served. All fire departments in Monroe County are volunteer. *Table 55 – Monroe County EMS Agencies* identifies each emergency medical service agency and the municipalities served. *Table 56 – Monroe County Law Enforcement Agencies* identifies each police department to include the Pennsylvania State Police (PSP) and the municipalities served. *Table 57 – Monroe County Specialty Teams* lists the teams and their specialty. This information was provided by the Monroe County Office of Emergency Management.

Table 54 - Monroe County Fire Departments

Monroe County Fire Departments	
Station Name	**Municipalities Covered**
#21 Acme Hose Company #1	East Stroudsburg Borough
#22 Barrett Township Volunteer Fire Department	Barrett Township
#23 Blue Ridge Hook & Ladder	Hamilton Township Ross Township
#24 Bushkill Volunteer Fire Department	Portions of Middle Smithfield Township Lehman Township, Pike County
#25 Coolbaugh Township Volunteer Fire Department	Coolbaugh Township
#26 Delaware Water Gap Volunteer Fire Department	Delaware Water Gap Borough Portions of Smithfield Township
#27 Jackson Township Volunteer Fire Department	Jackson Township
#28 Kunkletown Volunteer Fire Department	Eldred Township
#29 Marshalls Creek Volunteer Fire Department	Price Township Portions of Middle Smithfield Township Portions of Smithfield Township
#32 Pocono Mountain Volunteer Fire Department	Mount Pocono Borough Paradise Township
#33 Pocono Summit Volunteer Fire Department	Portions of Coolbaugh Township Portions of Tobyhanna Township Portions of Tunkhannock Township
#34 Pocono Township Volunteer Fire Department	Pocono Township
#35 Polk Township Volunteer Fire Department	Polk Township
#36 Shawnee Volunteer Fire Department	Portions of Middle Smithfield Township Portions of Smithfield Township
#37 Stroud Township Volunteer Fire Department	Stroud Township
#38 Stroudsburg Volunteer Fire Department	Stroudsburg Borough
#41 Tobyhanna Township Volunteer Fire Department	Tobyhanna Township Portions of Coolbaugh Township
#42 Tunkhannock Township Volunteer Fire Department	Tunkhannock Township Portion of Tobyhanna Township
#43 West End Fire Company	Chestnuthill Township

Station name	Municipalities covered
#47 Tobyhanna Army Depot Fire and Emergency Services	Tobyhanna Army Depot property in Coolbaugh Township

Table 55 - Monroe County EMS Agencies

Monroe County EMS Agencies			
Station name	**Service provided**	**Municipalities covered**	
		Full coverage	**Portion covered**
Bushkill Emergency Corps	ALS/BLS	Middle Smithfield Township Smithfield Township	Price Township Lehman Township, Pike County
Lehigh Valley MedEvac	Medical Helicopter		
Med Mobile EMS	Medical transport only		
Pocono Mountain Regional EMS	ALS/BLS	Barrett Township Coolbaugh Township Mount Pocono Borough Paradise Township Tobyhanna Township	Price Township Tunkhannock Township
St. Luke's Emergency & Transport Service	ALS/BLS	Jackson Township Pocono Township	Hamilton Township
St. Luke's/ Geisinger Life Flight	Medical Helicopter		
Suburban EMS	ALS/BLS	East Stroudsburg Borough Stroud Township Stroudsburg Borough	Delaware Water Gap Borough Smithfield Township
Thornhurst Ambulance Corps	BLS	Arrowhead Lake Development area in Coolbaugh Township	
West End Community Amb. Association	ALS/BLS	Chestnuthill Township Eldred Township Polk Township	Hamilton Township Ross Township

Table 56 - Monroe County Law Enforcement Agencies

Monroe County Law Enforcement Agencies		
Station name	**Municipalities covered**	
Delaware Water Gap PD	Delaware Water Gap Borough	
Pocono Mountain Regional PD	Barrett Township Coolbaugh Township Mount Pocono Borough	Tobyhanna Township Tunkhannock Township
Pocono Township PD	Pocono Township	
Stroud Area Regional PD	East Stroudsburg Borough Stroud Township	Stroudsburg Borough
PSP – Stroudsburg	Delaware Water Gap Borough Hamilton Township Jackson Township Middle Smithfield Township Paradise Township	Pocono Township Price Township Smithfield Township Tobyhanna Township Interstates 80/380 corridor
PSP – Fern Ridge	Chestnuthill Township	Jackson Township
PSP – Lehighton	Eldred Township	Ross Township

Table 57 - Monroe County Specialty Teams

Monroe County Specialty Teams	
Team Name	**Specialty**
Northeast Search & Rescue	Search and rescue
Pennsylvania Mountain Rescue	Search and rescue
Rescue International	Search and rescue
East Penn Search and Rescue	Search and rescue
First Strike Search and Rescue, Inc.	Search and rescue
Datom Products Inc.	Commercial contracted hazardous material response

4.3.15. Environmental Hazards/Hazardous Materials

4.3.15.1 Location and Extent

Environmental hazards in Monroe County are primarily caused by hazardous material releases. Hazardous materials fall into nine categories, including flammable and combustible materials, compressed gases, explosive and blasting agents, radioactive materials, oxidizing materials, poisons, and corrosive liquids. Hazardous materials incidents are generally unintentional and associated with transportation accidents or accidents at fixed facilities. However, hazardous materials can be released as a criminal or terrorist act. Any release can result in injury or death and may contaminate air, water and/or soils.

Facilities that use, manufacture, or store hazardous materials in Pennsylvania must comply with both Title III of the federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. The community right-to-know reporting requirement keeps communities abreast of the presence and release of chemicals at individual facilities. EPCRA was designed to ensure that state and local communities are prepared to respond to potential chemical accidents through local emergency planning committees (LEPCs). LEPCs are charged with developing emergency response plans for SARA Title III facilities; these plans cover the location and extent of hazardous materials, establish evacuation plans, response procedures, methods to reduce the magnitude of a materials release, and establish methods and schedules for training and exercises.

Because SARA Title III facilities are covered under their own unique planning process and are continually evaluated through the LEPC, this HMP will focus on the Environmental Protection Agency (EPA) identified hazardous materials sites known collectively as Toxic Release Inventory (TRI) sites. This dataset, publicly available at www.epa.gov/enviro/geo_data.html, includes the following materials facilities:

- Superfund National Priorities List sites.
- RCRAInfo (EPA and state treatment, storage, disposal) facilities.
- Toxic Release Inventory System sites.
- Integrated Compliance Information System and Permit Compliance System – national pollutant discharge elimination system majors.
- Resource Conservation and Recovery Act (RCRA) Info – large quantity generators.
- Air Facility System – major discharges of air pollutants.
- RCRAInfo – corrective actions.
- Risk management plan.
- Section Seven Tracking System sites (pesticides).
- ACRES – Brownfields properties.

Using this dataset will help to provide a more complete picture of the risk of hazardous materials releases in the county. *Table 58 – Monroe County Facility Registry Services* gives an overview of the number of facilities per zip codes within the county as identified by the Environmental Protection Agency.

Table 58 - Monroe County Facility Registry Services

EPA Facility Registry Services in Monroe County					
Zip Code	**Number of facilities**	**Zip Code**	**Number of facilities**	**Zip Code**	**Number of facilities**
18058	22	18332	5	18353	20
18301	160	18333	6	18354	7
18302	23	18334	4	18355	14
18321	19	18335	11	18356	7
18322	33	18342	3	18357	4
18323	3	18344	44	18360	196
18325	7	18346	23	18370	24
18326	31	18347	15	18372	47
18327	16	18349	5	18424	1
18330	13	18350	9	18466	39
18331	11	18352	4	18610	24

There are 345 SARA Title III facilities in Monroe County, of these 101 are Tier II facilities.

Transportation of hazardous materials on highways involves tanker trucks, trailers, or intermodal shipments; and are responsible for the greatest number of hazardous material release incidents. Hazardous material releases from rail transport are also of concern due to collisions and derailments that result in large spills. Monroe County has an extensive highway and railway network that pose a high risk for hazardous material incidents. These networks transport hazardous material daily, on interstate 80, as well as US Route 209 and Pennsylvania Routes 33 and 611. These major roads pass through very populous areas. Similarly, rail lines pass through cities and boroughs where large numbers of people could be vulnerable should a serious accident occur in these places.

Barrett Township has the only oil and gas well in Monroe County. This oil and gas well is plugged. The Pennsylvania Department of Environmental Protection also reports there are no orphan or abandoned wells in the county.

4.3.15.2 Range of Magnitude

Hazardous material releases can contaminate air, water, and soils, possibly resulting in death and/or injuries. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur because of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances,

and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

With a hazardous material release, whether accidental or intentional, there are several potentially exacerbating or mitigating circumstances that will affect its severity or impact. Mitigating conditions are precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place protects people and property from the harmful effects of a hazardous material release. Exacerbating conditions, or characteristics that can enhance or magnify the effects of a hazardous material release, include:

- Weather conditions affect how the hazard occurs and develops.
- Micro-meteorological effects of buildings and terrain alter dispersion of hazardous materials.
- Non-compliance with applicable codes (e.g., building or fire codes) and maintenance failures (e.g., fire protection and containment features) can substantially increase the damage to the facility itself and to surrounding buildings.

Flooding can cause a large-scale water contamination should the flood compromise the production or storage of hazardous chemicals. Such a situation could swiftly move toxic chemicals throughout a water supply and across great distances.

The severity of a given incident is dependent not only on the circumstances described above, but also with the type of material released and the distance and related response time for emergency response teams. The areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or remain present in the environment for a long period of time (e.g., centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

On the lower end of the range of magnitude, an environmental hazard could trigger an evacuation of the surrounding area and a cleanup. The worst-case scenario for a hazardous material release occurred in 2004 when a chemical being transported was released, resulting in both injuries and a major access route to be closed. An acid leaked while it was being transported by a FedEx truck through Monroe County. Interstate 80 was closed near Delaware Water Gap Borough while the acid was contained and cleaned up. Ten people were treated after being exposed to this acid.

4.3.15.3 Past Occurrence

The number and quantity of hazardous materials being produced, stored, and transported continue to increase each year in Pennsylvania. Cumulatively, EPA TRI records indicate that

there was a total of 3,942,063 pounds of chemicals released from fixed sites in Monroe County between 1987 and 2008 (EPA, 2008).

There were fifty-five incidences of hazardous material releases in Monroe County from 2002 to 2009. Thirteen of these incidences were from a fixed facility and twenty-six incidences happened during transit. *Table 59 – Hazardous Materials Incidents Reported Through PEIRS* shows the compiled list of incidents reported to PEIRS between 2002 to 2009. Since the PEIRS data is from a voluntary reporting system this may not be a complete data set.

Table 59 - Hazardous Materials Incidents Reported Through PEIRS

Hazardous Materials Incidents Reported Through PEIRS		
Date	**Location**	**Incident details**
01/23/2002	Hamilton Township	Chemical release
02/19/2002	Bartonsville	Chemical release
02/20/2002	Mount Pocono Borough	Kerosene spill
04/06/2002	Stroud Township	Hazardous waste materials
04/09/2002	Delaware Water Gap Borough	Tank ruptured causing a diesel fuel spill
05/02/2002	East Stroudsburg Borough	Chemical spill
05/03/2002	Delaware Water Gap Borough	Chemical release
05/09/2002	Delaware Water Gap Borough	Gasoline spill
08/09/2002	Middle Smithfield Township	Crude oil spill
09/16/2002	Snydersville	Diesel fuel spill
10/24/2002	Middle Smithfield Township	Flammable liquid leak from a tractor trailer on I-80.
10/27/2002	Tobyhanna Township	Over 300 gallons of diesel fuel spilled from a tractor trailer into Swiftwater Creek
11/14/2002	Delaware Water Gap Borough	A 55-gallon drum with petroleum distillates leaked in a tractor trailer
01/11/2003	Pocono Township	125 gallons of diesel fuel spilled from a ruptured saddle tank
03/04/2003	Pocono Township	Less than 55-gallons of petroleum spilled on the ground
05/22/2003	Delaware Water Gap Borough	Diesel fuel spilled onto the roadway after a tractor trailer accident

Date	Location	Incident details
09/23/2003	Arrowhead Lake	An unknown amount of petroleum spilled onto the ground
10/06/2003	Tannersville	Twenty pounds of cupric sulfate spilled from a bag while being unloaded from a truck
11/05/2003	Polk Township	Approximately 205 gallons of heating oil spilled and entered a tributary of Middle Creek
11/05/2003	Ross Township	Approximately 100 gallons of contaminated water from runoff from a recently treated roof ran into a retention pond
11/06/2003	Hamilton Township	Less than 55-gallons of gasoline spilled onto the ground
11/10/2003	Stroudsburg Borough	An unknown amount of asphalt sealer spilled from a truck
12/04/2003	Stroudsburg Borough	Approximately 150 gallons of diesel fuel spilled from a ruptured tank
03/15/2004	Tannersville	Over 250 gallons of diesel fuel spilled from a ruptured tank
04/14/2004	Tobyhanna Township	An unknown amount of lead material was released from malfunctioning equipment
04/16/2004	Delaware Water Gap Borough	Well drilling discharge – an undetermined amount of powdered clay was released into a pond
04/19/2004	Smithfield Township	Two gallons of bentonite was spilled from a drill into Cherry Creek
07/08/2004	Delaware Water Gap Borough	Acid spilled from a FedEx truck during transit. Ten people treated for exposure
01/15/2005	Tunkhannock Township	Over 200 gallons of kerosene was spilled from a storage tank
01/21/2005	Delaware Water Gap Borough	Two gallons of proprionitrile was spilled at a chemical plant, causing one injury
03/04/2005	Coolbaugh Township	1,800 gallons of propane released during a fire at the Coca Cola plant
04/07/2005	Coolbaugh Township	An undetermined amount of diesel fuel was released from an underground storage tank
06/03/2005	Coolbaugh Township	An undetermined amount of an unknown chemical was released in drinking water supply

Date	Location	Incident details
10/10/2005	Smithfield Township	200 gallons of an unknown tar was spilled on the roadway
06/06/2006	Tobyhanna Township	Over 100 gallons of diesel fuel was spilled on the roadway
07/01/2006	Delaware Water Gap Borough	An unknown amount of gear box oil was spilled from pumps into the Delaware River
07/14/2006	Middle Smithfield Township	A 1,000-gallon propane truck ruptured after being struck in an accident and began to leak
09/04/2006	Delaware Water Gap Borough	An unknown amount of paint was spilled on I-80
09/08/2006	Pocono Township	Over 90 gallons of diesel fuel was spilled from multiple tanks onto the roadway
12/22/2006	Polk Township	A propane release occurred after a valve was ruptured
01/05/2007	Tobyhanna Township	Approximately 300 gallons of ink spilled from a ruptured tank when the trailer overturned.
04/16/2007	Smithfield Township	Three gallons of renalyn spilled at a dialysis center; fourteen people were treated for exposure
07/03/2007	Middle Smithfield Township	Propane released from a tanker truck after being struck during an accident
08/03/2007	Delaware Water Gap Borough	A 55-gallong drum of peroxide exploded in a laboratory, one injury was reported
08/23/2007	Stroudsburg Borough	An unknown amount of coal tar seeped out of the ground, and into a nearby creek
10/09/2007	Hamilton Township	Approximately 100 gallons of diesel fuel spilled from a tractor trailer truck
11/09/2007	Hamilton Township	Approximately 300 gallons of diesel fuel spilled following a vehicle accident
12/29/2007	Coolbaugh Township	Approximately 250 gallons of kerosene was released from a ruptured holding tank
01/02/2008	Pocono Township	Propane was released when a tanker truck overturned
01/12/2008	Delaware Water Gap Borough	18,000 pounds of maleic anhydride spilled from a holding tank, four injuries reported
01/23/2008	Pocono Township	100 gallons of fuel oil spilled from a damaged tanker truck

Date	Location	Incident details
02/20/2008	Delaware Water Gap Borough	An unknown amount of butyl acetate was spilled from a tractor trailer onto I-80
06/11/2008	Tobyhanna Township	150 gallons of diesel fuel spilled after an accident; some fuel leaked towards Tobyhanna Creek
09/10/2008	Pocono Township	A truck carrying ammonium nitrate and dynamite was in an accident and overturned on I-80, an unknown amount of antifreeze and diesel fuel leaked
02/12/2009	Polk Township	A petroleum product was spilled onto a roadway

Table 60 – Environmental Hazards lists the reported incidents in Monroe County on the on-line database Corvena (formerly Knowledge Center™) from June 2009 to January 26, 2021.

Table 60 - Environmental Hazards

Environmental Hazards from 2009 to January 26, 2021		
Date	**Location**	**Incident details**
06/28/2009	Middle Smithfield Township	Hazmat spill
12/27/2009	Pocono Township	Hazmat incident
01/03/2010	Tobyhanna Township	Fuel spill
02/24/2010	East Stroudsburg Borough	Gas leak
05/17/2010	Mount Pocono Borough	Chemical spill
05/19/2010	Stroud Township	Medical waste
06/11/2010	Pocono Township	Diesel fuel spill
08/18/2010	Stroud Township	Suspicious substance
10/04/2010	Chestnuthill Township	Propane truck collapses small bridge
10/19/2010	Stroudsburg Borough	Broken gas line
01/10/2011	East Stroudsburg Borough	Gas leak
02/05/2011	Tobyhanna Township	Natural gas leak
03/01/2011	Coolbaugh Township	Hydrogen suicide threat
03/11/2011	Tobyhanna Township	Fuel truck in a ditch
03/17/2011	Coolbaugh Township	Propane leak
03/26/2011	Pocono Township	Fuel spill
05/10/2011	Stroud Township	Hydraulic fluid spill
06/20/2011	Smithfield Township	Oil spill
06/20/2011	Coolbaugh Township	Fuel spill

Date	Location	Incident details
07/31/2011	Stroud Township	Explosive device found
08/09/2011	Chestnuthill Township	Gasoline spill and fire
08/16/2011	Hamilton Township	Diesel fuel spill
08/23/2011	Stroudsburg Borough	Gas line break
09/12/2011	Stroud Township	Odor of propane in a commercial business
10/16/2011	Stroud Township	Gas main leak
11/18/2011	Tobyhanna Township	Vehicle accident with hazmat spill
12/15/2011	Coolbaugh Township	Vehicle accident with fuel spill
01/07/2012	Stroud Township	Possible methamphetamine lab explosion
01/28/2012	Smithfield Township	Vehicle accident with hazmat spill
02/20/2012	Coolbaugh Township	Meth lab
02/20/2012	Delaware Water Gap Borough	Hydraulic fluid spill
02/23/2012	East Stroudsburg Borough	Chemical suicide
05/12/2012	East Stroudsburg Borough	Vehicle accident with a fuel spill
05/25/2012	Monroe County	Raw sewage dumping
07/11/2012	Delaware Water Gap Borough	Diesel fuel spill
07/30/2012	East Stroudsburg Borough	Chemical spill
08/30/2012	Ross Township	Mobile meth lab
09/17/2012	Hamilton Township	Tractor trailer accident with a fuel spill
10/02/2012	Stroud Township	Propane leak with a road closure
10/06/2012	Barrett Township	Propane tank leak
10/10/2012	Tobyhanna Township	Oil spill
10/12/2012	East Stroudsburg Borough	Gas leak
10/15/2012	Stroudsburg Borough	Diesel spill
10/15/2012	Smithfield Township	Natural gas leak
11/03/2012	Middle Smithfield Township	Gas leak
11/04/2012	Stroudsburg Borough	Fuel spill
01/02/2013	East Stroudsburg Borough	Hazardous materials incident
01/04/2013	Chestnuthill Township	Fuel spill
01/09/2013	Tobyhanna Township	Diesel fuel spill
01/28/2013	Hamilton Township	Vehicle accident with a fuel leak
02/06/2013	Monroe County	Residential oil leak
02/26/2013	Monroe County	Methane incident at EMS station

Date	Location	Incident details
06/30/2013	Monroe County	Fuel spill
07/23/2013	Ross Township	Gas venting
07/23/2013	Stroudsburg Borough	Residential natural gas leak
07/25/2013	Monroe County	HazMat spill
07/26/2013	Coolbaugh Township	Diesel fuel spill
08/02/2013	Stroudsburg Borough	Explosive device found
09/24/2013	Mt. Pocono Borough	Propane leak
10/04/2013	Tobyhanna Township	Hazmat spill
12/21/2013	Stroudsburg Borough	Natural gas odor
01/08/2014	Stroud Township	Transformer fire at GPU/MetEd substation
02/17/2014	Hamilton Township	Propane leak
02/28/2014	Chestnuthill Township	Fuel spill at a residence
03/18/2014	Coolbaugh Township	Gasoline spill
04/01/2014	Tobyhanna Township	Natural gas release
04/10/2014	Hamilton Township	Vehicle accident with a fuel leak
04/17/2014	Tunkhannock Township	Vehicle struck a gas pump
05/20/2014	Coolbaugh Township	Gas leak
05/20/2014	Monroe County	Sewage leak
05/27/2014	Monroe County	Hazardous material fire and exposure
06/26/2014	Pocono Township	Hazmat leak
07/02/2014	Stroudsburg Borough	Natural gas main line break
08/01/2014	Monroe County	Grenade found
08/05/2014	Tobyhanna Township	Vehicle accident with hazardous materials spill
08/11/2014	Jackson Township	Unknown substance spilled
08/15/2014	East Stroudsburg Borough	Gas line leak
08/18/2014	Hamilton Township	Hazmat spill
08/19/2014	Monroe County	Vehicle accident with fuel spill
08/23/2014	Monroe County	Fuel leak
09/02/2014	Eldred Township	Propane leak
09/18/2014	Chestnuthill Township	Hazardous material incident at a commercial building
09/25/2014	Chestnuthill Township	Oil sheen
10/05/2014	Tobyhanna Township	Tractor trailer accident with a fuel spill
10/21/2014	Hamilton Township	Diesel fuel spill
12/10/2014	Stroudsburg Borough	Collapse with a gas leak
12/18/2014	Coolbaugh Township	Diesel fuel spill

Date	Location	Incident details
12/24/2014	Middle Smithfield Township	One gallon of gasoline spilled
01/30/2015	Jackson Township	Fuel spill
02/27/2015	Tobyhanna Township	Fuel spill
04/23/2015	Stroud Township	Fuel leak
07/09/2015	Monroe County	Ordinance found
07/23/2015	Tobyhanna Township	Hazardous materials spill
09/04/2015	Stroudsburg Brough	Live virus found in a refrigerator
09/09/2015	Stroud Township	Natural gas leak
09/23/2015	Eldred Township	Chemical release
10/18/2015	Mt. Pocono Borough	Commercial fumigation
11/09/2015	Stroud Township	Vehicle accident with hazardous materials spill
02/05/2016	Stroudsburg Borough	Diesel spill
03/12/2016	Hamilton Township	Grenade found
05/27/2016	Smithfield Township	Ordinance located
07/27/2016	East Stroudsburg Borough	Diesel fuel spill
08/31/2016	Pocono Township	Fuel spill
09/30/2016	Monroe County	Gas leak
10/10/2016	Stroudsburg Borough	Propane gas leak
11/02/2016	Middle Smithfield Township	Propane leak
11/29/2016	Stroud Township	NRC#1165378
01/25/2017	Smithfield township	Vehicle accident with a fuel spill
02/13/2017	Pocono Township	Diesel fuel spill
03/06/2017	Coolbaugh Township	Propane gas leak
04/12/2017	Coolbaugh Township	Diesel spill
06/09/2017	Stroud Township	Fuel spill
06/13/2017	Stroudsburg Borough	Fuel leak
06/25/2017	Pocono Township	Vehicle accident with a fuel spill
07/27/2017	Jackson Township	NRC#1185431
08/30/2017	East Stroudsburg Borough	Chlorine gas incident
01/03/2018	Pocono Township	Fuel spill
02/27/2018	Stroud Township	NRC#1205383
05/14/2018	East Stroudsburg Borough	Natural gas leak
05/15/2018	Eldred Township	NRC#1212441
06/24/2018	Chestnuthill Township	NRC#1216293

Date	Location	Incident details
07/03/2018	Tobyhanna Township	Vehicle accident with a fuel spill
07/09/2018	Stroudsburg Borough	Gas leak
07/23/2018	East Stroudsburg Borough	Gas leak
08/11/2018	Monroe County	Natural gas leak
08/17/2018	Middle Smithfield Township	Gasoline spill
10/22/2018	Stroudsburg Brough	Vehicle accident with a fuel spill
10/24/2018	Stroud Township	Natural gas leak
11/11/2018	Smithfield Township	Gas leak from a vehicle
12/07/2018	Tunkhannock Township	Diesel fuel spill
02/01/2019	Stroud Township	Residential oil leak
02/22/2019	Barrett Township	Unknown sheen
04/05/2019	Stroud Township	Hazardous materials incident
08/23/2019	Coolbaugh Township	Fuel spill
09/12/2019	Stroudsburg Borough	Unknown oil on a roadway
10/11/2019	Stroudsburg Borough	Home heating oil spill
12/09/2019	East Stroudsburg Borough	Fuel spill
12/20/2019	Tobyhanna Township	Fuel leak
01/03/2021	East Stroudsburg Borough	Dumping
01/14/2020	Chestnuthill Township	Chemical spill
02/03/2020	Stroud Township	Heating oil spill
03/10/2020	Pocono Township	Dumping
04/20/2020	Coolbaugh Township	Sewage discharge
04/22/2020	Pocono Township	Chemical spill
04/25/2020	Tobyhanna Township	Natural gas leak
07/19/2020	Paradise Township	Fuel spill

4.3.15.4 Future Occurrence

While many incidents involving hazardous materials releases have occurred in Monroe County in the past, they are generally difficult to predict. Any occurrence is largely dependent upon the accidental or intentional actions of a person or group. Population growth, especially in areas close to transportation routes, can expose more people to these hazards if a release incident occurs.

4.3.15.5 Vulnerability Assessment

Populations in and around communities that are home to SARA Tier II sites are more vulnerable to facility releases, particularly those within ¼ mile of the facility. *Figure 51 – SARA Tier II Facility Vulnerability* identifies the locations of the SARA Tier II facilities and the conventional

well. *Figure 52 – Transportation Accidents Vulnerability* identifies the quarter mile vulnerability area along transportation routes and outlines where critical infrastructure and functional needs structures are located.

Quick response to hazardous materials incidents minimizes the volume and concentration dispersed through air, water, and soil. Every municipality within Monroe County is vulnerable to a hazardous materials incident, whether it occurs along a highway, railway, pipeline, commercial structure, or residential structures.

Figure 51 - SARA Tier II Facility Vulnerability

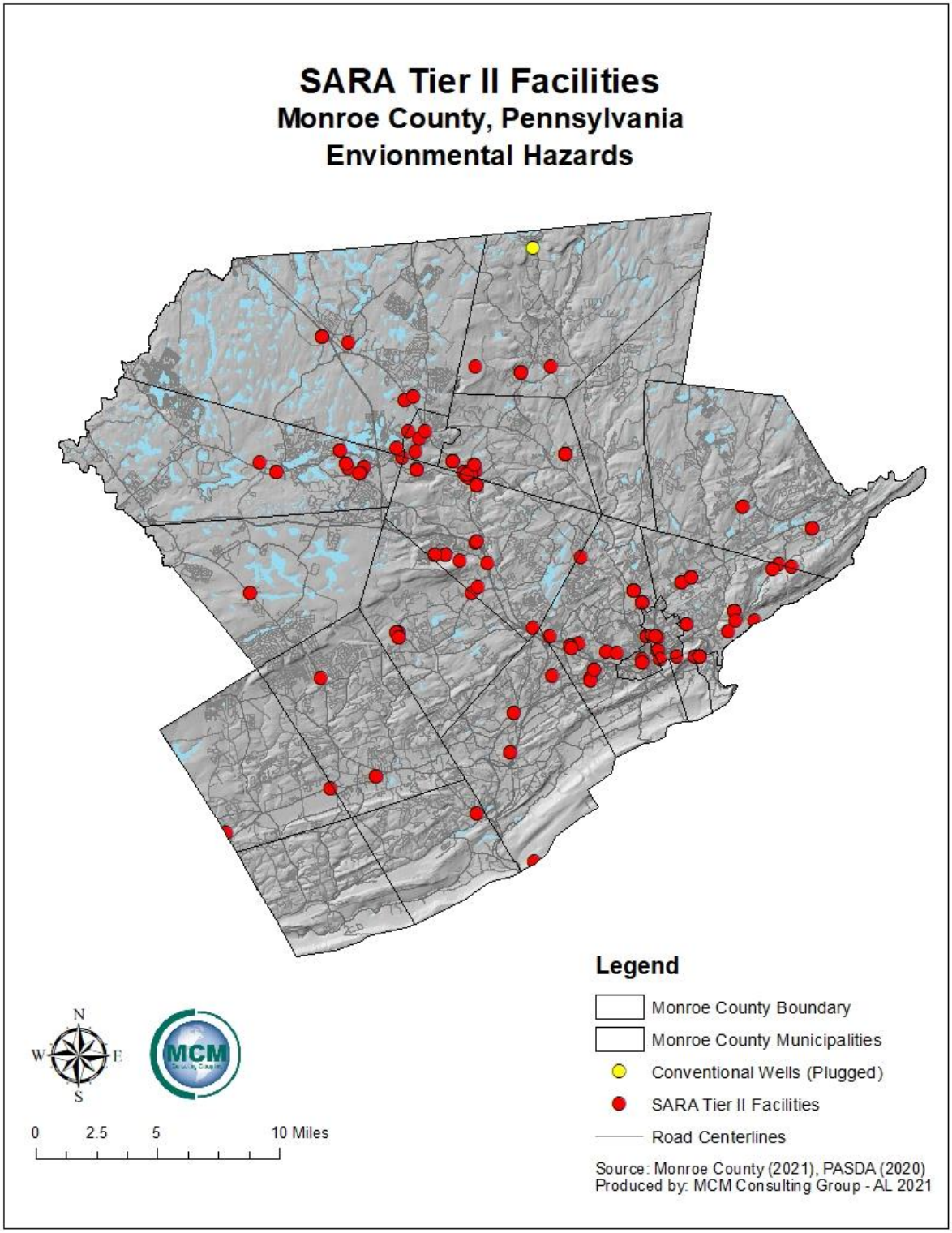
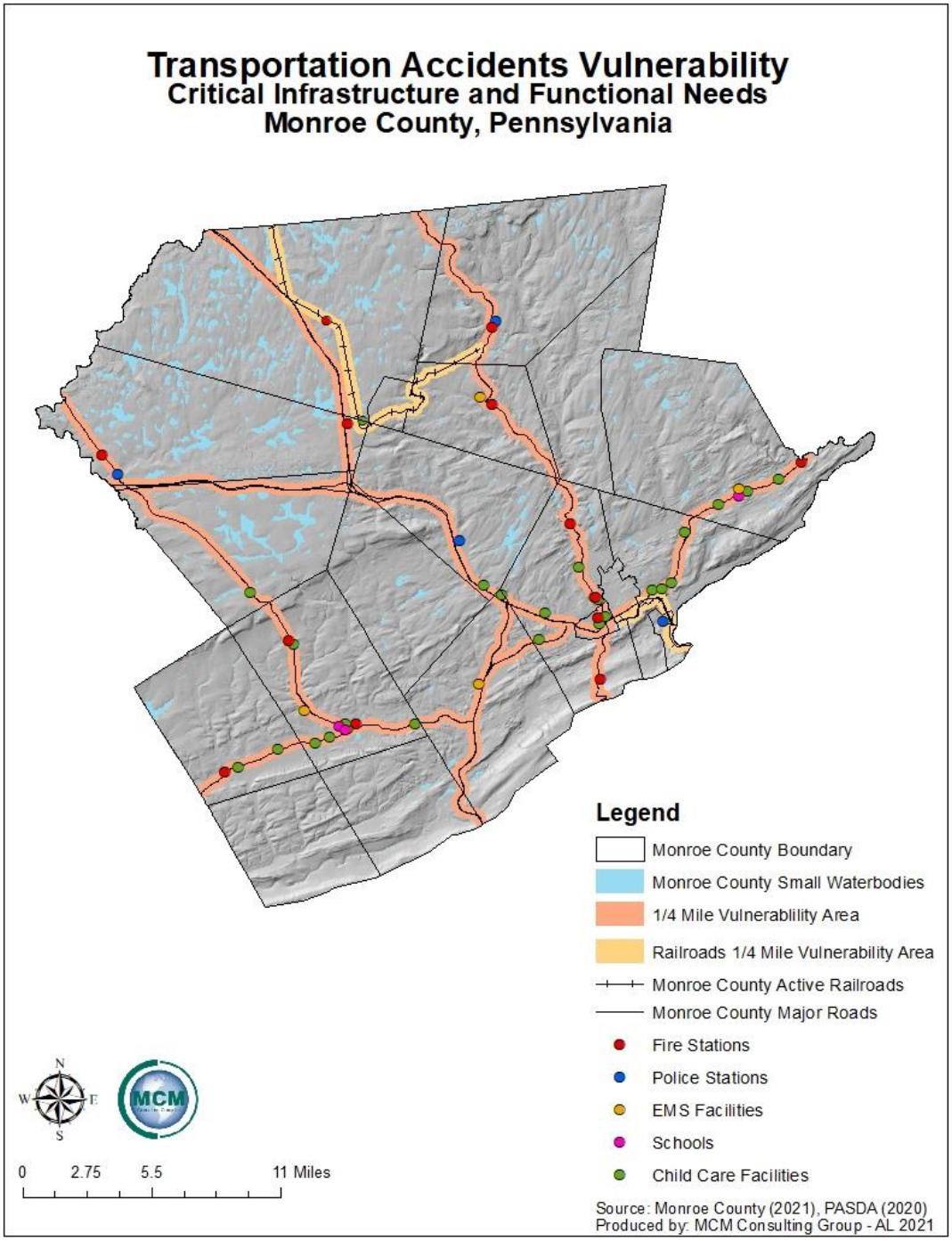


Figure 52 - Transportation Accidents Vulnerability



4.3.16. Nuclear Incidents

4.3.16.1 Location and Extent

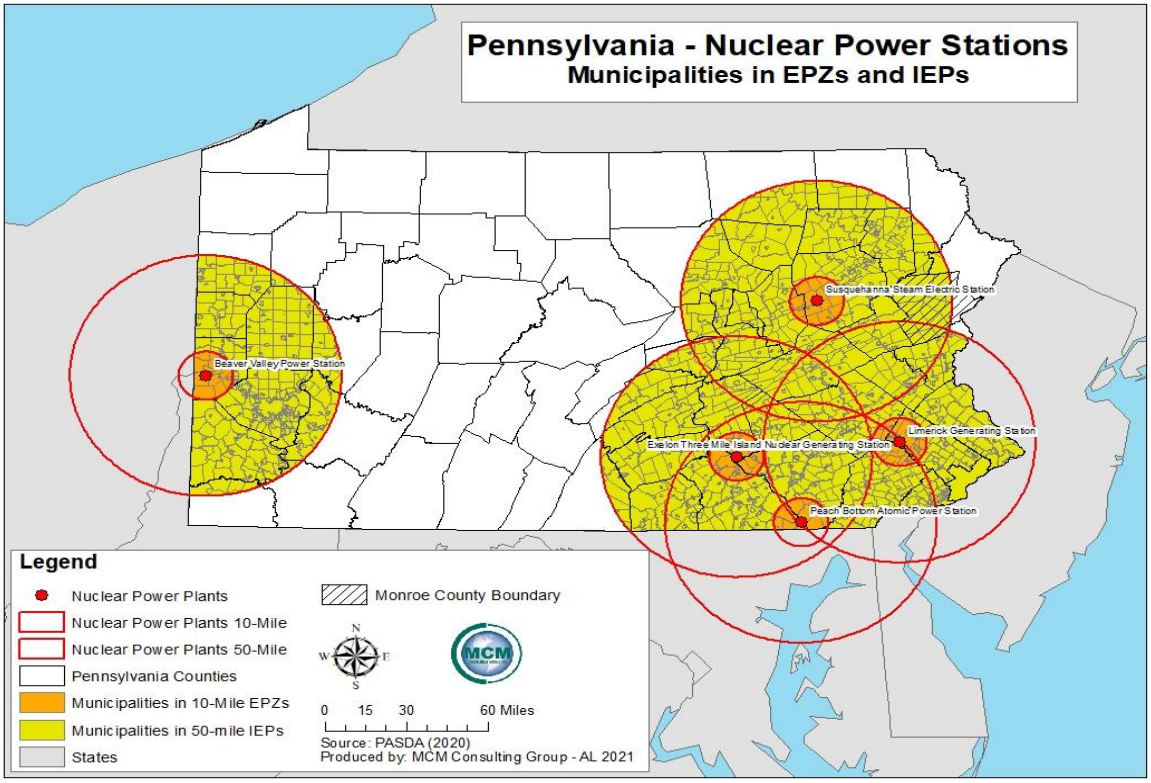
Nuclear hazards and incidents generally refer to incidents involving (1) a release of significant levels of radioactive materials or (2) exposure of workers or the general public to radiation. Primary concerns following a nuclear incident or accident are: the impact on public health from direct exposure to a radioactive plume; inhalation of radioactive materials; ingestion of contaminated food, water, and milk; and long-term exposure to deposited radioactive materials in the environment that may lead to acute health effects (e.g., death, burns, severe impairments), chronic health effects (e.g., cancer), and psychological effects.

Nuclear accidents/incidents can be placed into three categories: (1) criticality accidents which involve loss of control of nuclear assemblies or power reactors; (2) loss-of-coolant accidents which result whenever a reactor coolant system experiences a break or opening large enough that the coolant inventory in the system cannot be maintained by the normally operating make-up system; and (3) loss-of-containment accidents which involve the release of radioactivity.

A nuclear power facility makes electricity by continuously splitting uranium atoms. Within the Commonwealth of Pennsylvania, there are five nuclear power stations. These are:

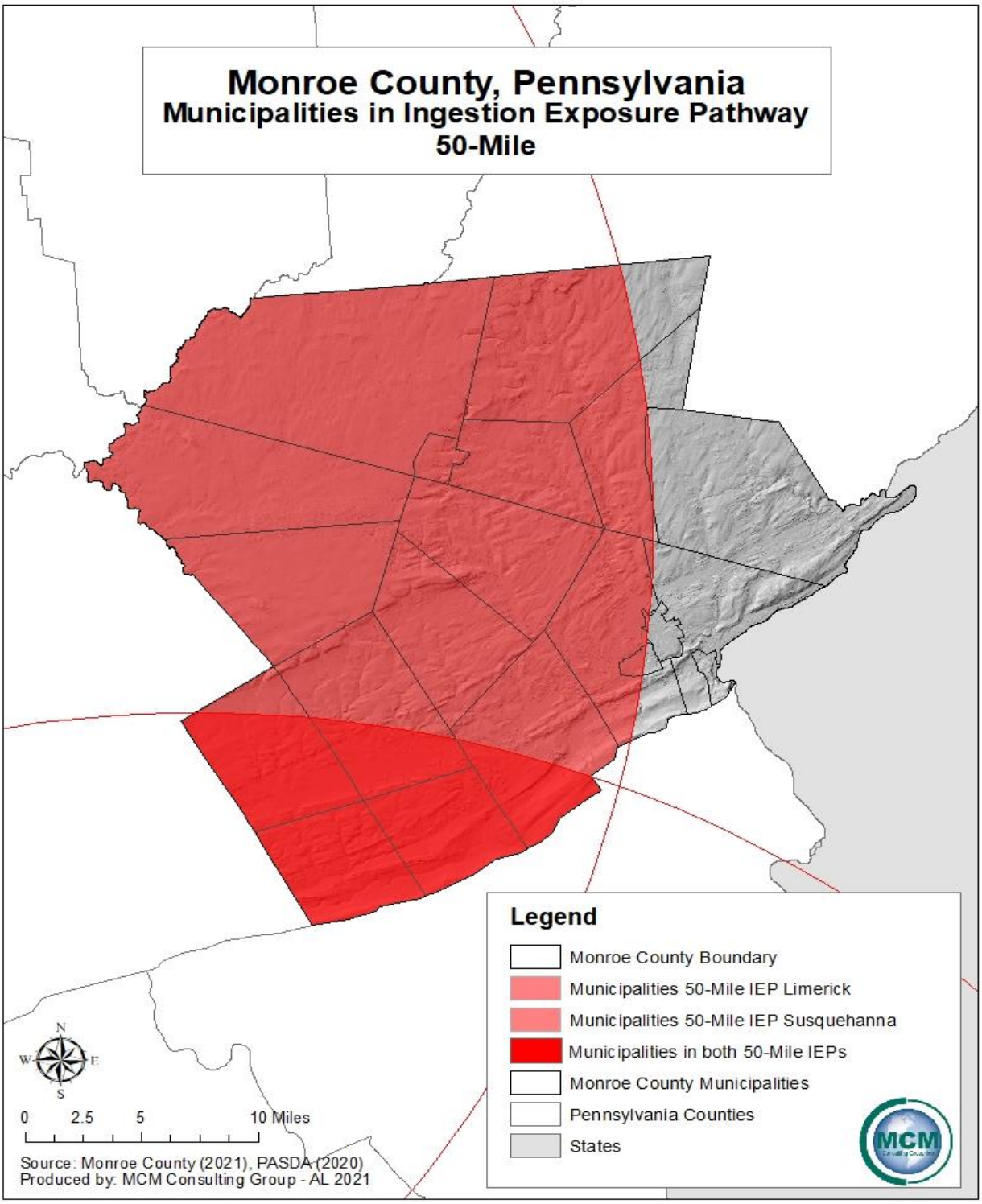
- Beaver Valley Power Station, Beaver County;
- Limerick Generating Station, Montgomery County;
- Peach Bottom Atomic Power Station, York County;
- Susquehanna Steam Electric Station, Luzerne County; and,
- Three Mile Island Nuclear Generating Station, Dauphin County. (This station's license expired in 2019 and its owners have begun the decommissioning process; at the time of the writing of this plan, the station was for sale, but it must still adhere to many of the tenets of federal and state emergency response plans.)

Figure 53 - Pennsylvania Nuclear Power Stations



Two of the nuclear power stations are within fifty miles of the Monroe County border: *Susquehanna Steam Electric Station*, located approximately twenty-eight miles west of the county border in Salem Township, Luzerne County and *Limerick Generating Station*, located approximately forty-one miles to the southwest in Limerick Township, Montgomery County. See *Figure 54 - Monroe County Municipalities in the 50-Mile Ingestion Exposure Pathways.*

Figure 54 - Monroe County Municipalities in the 50-Mile Ingestion Exposure Pathways



Nearly all of the county is within the fifty-mile planning zone of the Susquehanna Steam Electric Station; Polk, Chestnuthill, Eldred, and Ross Townships are within the fifty-mile planning zone of the Limerick Generating Station. The other three Commonwealth nuclear facilities are more than fifty miles away from Monroe County and considered minimal threats; however, in the event of an emergency, evacuees from distant EPZs may seek shelter in Monroe County or pass through the county and use local services.

4.3.16.2 Range of Magnitude

The Nuclear Regulatory Commission encourages the use of Probabilistic Risk Assessments (PRAs) to estimate quantitatively the potential risk to public health and safety considering the design, operations, and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. The Federal Emergency Management Agency (FEMA), the Pennsylvania Emergency Management Agency (PEMA), and county governments have formulated Radiological Emergency Response Plans that include a Plume Exposure Pathway Emergency Planning Zone (EPZ) with a radius of about ten miles from each nuclear power facility and an Ingestion Exposure Pathway EPZ with a radius of about fifty miles from each facility. See *Table 61 - Emergency Planning Zones*. The exact size and configuration of the EPZ may vary in relation to local emergency response capabilities, topography, road networks, and political boundaries.

Table 61 - Emergency Planning Zones

Emergency Planning Zones	
EPZ	**Description**
Plume Exposure Pathway (PEP)	Has a radius of about 10 miles from each reactor site. Predetermined protective action plans are in place and include sheltering, evacuation, and the use of potassium iodide where appropriate.
Ingestion Exposure Pathway (IEP)	Has a radius of about 50 miles from each reactor site. Predetermined protective action plans are in place and are designed to avoid or reduce dose from potential ingestion of radioactive materials. These actions include a ban of contaminated food and water.

Source: U.S. Nuclear Regulatory Commission http://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/planning-zones.html

The magnitude of a nuclear incident differs for those within the Plume Exposure Pathway EPZ and those within the Ingestion Exposure Pathway EPZ. The Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation.

Fixed facility incidents are not the only types of incidents that could affect Monroe County. Other types of incidents such as transportation or terrorism could also pose a hazard. The Tobyhanna Army Depot located within the county borders could pose a significant threat as a terrorism target.

In the event of a nuclear disaster, radioactive fallout would be the main danger of an incident within a fifty-mile radius. Invisible gamma rays from this fallout can cause radiation sickness due to physical and chemical changes in the cells of the body. If a person would receive a large dose of radiation, that person would die in a very short time. Non-lethal doses in varying degrees would cause radiation sickness among the survivors. Depending on the location of the event all of Monroe County could be in the Ingestion Exposure Pathway.

The Nuclear Regulatory Commission uses four classification levels for nuclear incidents:

Unusual Event
Events are in process or have occurred which indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.

Alert
Events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guides (PAGs).

Site Area Emergency
Involves events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA PAGs except near the site boundary.

General Emergency
Involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs for more than the immediate site area.

The nuclear industry has adopted predetermined, site-specific Emergency Action Levels (EALs). The EALs provide the framework and guidance to observe, address, and classify the severity of site-specific incidents and conditions that are communicated to off-site emergency response organizations (Nuclear Regulatory Commission, 2008). There are additional EALs that specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or facility attack. These EALs ensure that appropriate notifications for the security threat are made in a timely manner. Each facility is also equipped with a public alerting system, which includes several sirens to alert the public located in the Plume Exposure Pathway EPZ. This alerting system is activated by the counties of each specific EPZ. Emergency notifications and instructions are communicated to the public via the Emergency Alert System as activated by the Commonwealth Resource Coordination Center (formerly Pennsylvania State Emergency Operations Center). State officials also have the capability to send emergency messages as text messages to mobile devices.

During and after a nuclear incident, the primary concern is the effect on the health of the population near the incident. The duration of primary exposure could range in length from hours to months depending on the proximity to the point of radioactive release. External radiation and inhalation and ingestion of radioactive isotopes can cause acute health effects (e.g., death, severe health impairment), chronic health effects (e.g., cancers) and psychological effects.

Potential environmental impacts specific to the fifty-mile Ingestion Exposure Pathway EPZ, and therefore of most concern to Monroe County, include the long-term effects of radioactive contamination in the environment and in agricultural products. Monroe County can expect some radioactive contamination in very small amounts in the case of a nuclear incident at either of the two stations nearest it. This is not a significant concern in terms of external exposure and immediate health risks, but even a small amount of radiation will require the protection of the food chain, particularly milk supplies. Small amounts of radiation ingested over time could lead to future health issues. As a result, in the case of a nuclear incident, foodstuffs, crops, milk, livestock feed and forage, and farm water supplies will need to be protected from and tested for contamination. Additionally, spills and releases of radiologically active materials from accidents can result in the contamination of soil and public water supplies. Areas underlain by limestone and some types of glacial sediments are particularly susceptible to contamination.

The worst-case scenario for Monroe County would be a General Emergency at Susquehanna Steam Electric Station that leaked sufficient radiation to create longer-term damage in the form of contaminated water, soil, and food supplies.

4.3.16.3 Past Occurrence

Nuclear incidents rarely occur, but the incident at Three Mile Island in Dauphin County is the worst fixed nuclear facility accident in U.S. history. The resulting contamination and state of the

reactor core led to the development of a 14-year cleanup and scientific effort. Additionally, the *President's Commission on the Accident at Three Mile Island* examined the costs of the accident, concluding that "the accident at Three Mile Island on March 28, 1979, generated considerable economic disturbance. Some of the impacts were short term, occurring during the first days of the accident. Many of the impacts were experienced by the local community; others will be felt at the regional and national levels." The report concluded: "It appears clear that the major costs of the TMI Unit 2 accident are associated with the emergency management replacement power and the plant refurbishment or replacement. The minimum cost estimate of nearly one billion dollars supports the argument that considerable additional resources can be cost effective if spent to guard against future accidents."

Despite the severity of the damage, no injuries due to radiation exposure occurred. However, numerous studies were conducted to determine the measurable health effects related to radiation and/or stress. More than a dozen epidemiological and stress-related studies conducted to date have found no discernible direct health effects on the population in the vicinity of the plant. However, one study conducted by the Pennsylvania Department of Health's *Three Mile Island Health Research Program* did find evidence of psychological stress, "lasting in some cases for five to six years." According to the program chief, "the people suffering from stress perceived their health as being poorer than it actually was when the health department checked the medical records."

The accident at Three Mile Island had a profound effect on residents, the emergency management community, government officials, and nuclear industry, not only in Pennsylvania, but nationwide. There were minimal requirements for off-site emergency planning for nuclear power stations prior to the accident. Afterward, comprehensive, coordinated, and exercised plans were developed for the state, counties, school districts, special facilities (hospitals, nursing homes, day care centers, and detention facilities) and municipalities to ensure the safety of the populations. Costs associated with an incident at one of the Commonwealth's nuclear facilities, be it real or perceived, are significant. The mitigation efforts put in place immediately following the 1979 accident continue until today. The Commonwealth's nuclear/radiological plan, which is a successor of the original "Annex E," is a result of the Commonwealth's efforts to address the many components of mitigation planning. The comprehensive planning involving its five nuclear facilities is an ongoing effort. Plans are reviewed and amended on an annual basis.

Another incident occurred at Three Mile Island on February 7, 1993, when an individual drove his car through a chain-link fence and then slammed into a roll-up garage door leading into the facility's turbine building. Plant officials, fearing the worst, immediately declared a Site Area Emergency. Fortunately, the person who crashed the gate was found and apprehended. Other than property damage caused by the forcible entry through physical structures, there was no lasting damage to the facility.

Monroe County has not been affected by a fixed nuclear facility incident from any of the two local or other state facilities. The county has not been affected by any type of nuclear incident.

4.3.16.4 Future Occurrence

Pennsylvania is the site of the only nuclear power plant in the country with an incident rated as a General Emergency. Since the Three Mile Island incident, nuclear power has become significantly safer and is one of the most heavily regulated industries in the nation. Despite the knowledge gained since then, there is still the potential for a similar accident to occur again at any of the nuclear generating facilities nearest the county. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development notes that studies estimate the chance of a breach of protective barriers in a modern nuclear facility at less than one in 100,000 per year (Nuclear Energy Agency, 2005). Nuclear incident occurrences may also happen because of intentional actions, but these terrorist acts are rare. Nuclear incidents in or near Monroe County should be considered unlikely.

4.3.16.5 Vulnerability Assessment

In addition to the areas of Monroe County facing direct contamination risk, the entire county could also be affected on some level by incidents from any of the other nearby nuclear facilities, including the one at Indian Point in Westchester County, New York. Evacuation of residents from these areas could lead to increased population or through-traffic in the county. County residents could be negatively impacted through the psychological effects of a nuclear incident as the effects and likelihood of radiation contamination are not always well understood by the public.

Fifteen of Monroe County's twenty municipalities fall wholly or partially within the fifty-mile EPZ of either the Susquehanna Steam Electric Station or the Limerick Generating Station. According to the 2019 U.S. Census Estimate, this represents a population of 126,892 and covers the bulk of Monroe County's agricultural land cover. These jurisdictions include Barrett, Coolbaugh, Tobyhanna, Tunkhannock, Polk, Eldred, Ross, Chestnuthill, Hamilton, Jackson, Pocono, Paradise, Price and Stroud townships and Mount Pocono Borough.

The county's primary vulnerability to nuclear incidents comes in the form of food, soil, and water contamination. In terms of vulnerable land, the majority of the 27,607 acres of farmland held in Monroe County's 233 farms are vulnerable to radiological contamination in a nuclear incident. In 2017, the market value of all agricultural products of these farms was nearly $10 million.

Water contamination is also a concern in nuclear incidents. There are several public water suppliers that operate in or provide water to the county; the largest of them are: Pocono Jackson Joint Water Authority, Brodhead Creek Regional Authority, East Stroudsburg Borough Water

Department, and the Bethlehem Water Authority. These water supplies, coupled with the county's 19,681 estimated domestic drinking water wells, are all vulnerable to the effects of a nuclear incident.

While unlikely that all agricultural products would be lost in the event of a nuclear incident, the county could expect some portion of that $10 million to be lost. Time of year also impacts the vulnerability and losses estimated for a nuclear incident; an incident that occurs during the prime growing and harvesting season will have a larger impact on the county. For example, the incident at Three Mile Island occurred in the off-season; as a result, the Pennsylvania Department of Agriculture estimated that agricultural losses for the entire Commonwealth were not more than $1 million.

4.3.17. Opioid/Substance Abuse

4.3.17.1 Location and Extent

Pennsylvania and the United States at large have been experiencing an epidemic of opioid drug abuse. Opioid addiction occurs when an individual becomes physically dependent on opioids. Opioids are a class of drug that interact with receptors on nerve cells in the body and brain. The use of opioids is a broad term and includes opiates, which are drugs naturally extracted from certain types of poppy plants, and narcotics. Opioids can also be synthetically made to emulate opium. Opioid drugs are highly addictive and typically result in increasing numbers of overdose deaths both prescribed (e.g. fentanyl) and illicit (e.g. heroin) opioids. Overdose deaths from opioids occur when a large dose slows breathing, which can be likely when opioids are combined with alcohol or antianxiety drugs. While generally prescribed with good intentions, opioids can be over-prescribed, resulting in addiction.

According to the Drug Enforcement Administration (DEA), opioids come in various forms such as tablets, capsules, skin patches, powder, chunks in various colors from white to brown/black, liquid form for oral or injection use, syrups, suppositories, and lollipops. The Centers for Disease Control and Prevention (CDC) defines the following as the three most common types of opioids:

- **Prescription Opioids**: Opioid medication prescribed by doctors for pain treatment. These can be synthetic oxycodone (OxyContin), hydrocodone (Vicodin), or natural (morphine).
- **Fentanyl**: A powerful synthetic opioid that is 50 to 100 times more powerful than morphine and used for treating severe pain; illegally made and distributed fentanyl is becoming more prevalent.
- **Heroin**: An illegal natural opioid processed from morphine which is becoming more commonly used in the United States.

While other addictive substances such as methamphetamines and alcohol can be problematic for the health of individuals in Monroe County, this profile focuses on opioid drugs and the opioid epidemic. The opioid crisis was declared to be a public health emergency on October 26, 2017. While the declaration provides validation for the scope and severity of the problem, it was not accompanied by any release of funding for mitigating actions. On January 10, 2018, Governor Tom Wolf declared the opioid epidemic to be a statewide public health disaster emergency for Pennsylvania. The declaration is intended to enhance response and increase access to treatment.

4.3.17.2 Range of Magnitude

Opioid addiction can lead to overdose, which can be fatal. This type of addiction can affect others that are not the user themselves. The most dangerous side effect of an opioid overdose is depressed breathing. The lack of oxygen to the brain causes permanent brain damage, leading to organ failure, and eventually death. Opioid addiction can also be passed from mother to child in the womb. This condition, known as neonatal abstinence syndrome, has increased five-fold, according to the National Institute on Drug Abuse (NIDA). This results in an estimated 22,000 babies in the United States born with this condition. First responders such as paramedics, police officers, and firefighters are also affected by the opioid addiction crisis. First responders face exposure risk due to an increase of crisis, consuming time and resources, particularly to synthetic fentanyl. Two to three milligrams of fentanyl cause an induced respiratory depression, arrest, and possibly death to occur.

According to the Center for Disease Control and Prevention (CDC), more than 192 Americans die every day from an opioid overdose. In 2014, 2,732 overdose deaths were reported across Pennsylvania. This number increased to 3,264 reported overdose deaths in 2015, an increase of 19.5%. Reported overdose deaths increased again in 2016 to 4,627, an increase of 41.7% from 2015, then again to a total of 5,388 deaths in 2017. From 2015 - 2017, the increase in reported drug related overdose deaths in Pennsylvania increased 65%. This increased the need for the gubernatorial disaster declaration in Pennsylvania on January 10, 2018. Heroin and fentanyl are the two drugs most often found in overdose deaths, and they are considered to be highly available and nearly ubiquitous in Pennsylvania.

4.3.17.3 Past Occurrence

In 2020, there was an estimated total of 81,000 drug-related overdose deaths in the United States. This number is the highest number of overdose death ever recorded in a 12-month period, according to the recent provisional date from the CDC. Monroe County experienced a total of 2,246 drug-related deaths from 2016 - 2021. For 2021, data was only as recent as February 28, 2021. There was a total of 497 overdose deaths in Monroe County in 2020. The municipality that contributed the most deaths to this total was Coolbaugh Township with fifty overdose deaths. In 2020, the most commonly used opioids in Monroe County were cannabis and cocaine,

as seen in *Table 64 – Drugs Present in 2020 Pennsylvania Overdose Deaths.* As of February 28, 2021, Monroe County is already at seventy-two overdose related deaths. With the number of overdose deaths already at seventy-two, two months into the year of 2021, the potential for 2021 having the highest numbers of overdose related deaths is increasingly possible. The municipalities of Pocono Township, Smithfield Township, and Stroud Township have had the most deaths in 2021 so far. The lowest total of overdose-related deaths for Monroe County was the year 2017 with only 307 deaths total. All this and more information about overdose-related deaths is seen in *Table 62 – Overdose Total by Municipality for Monroe County*, *Figure 55 – Monroe County Overdose Death History 2016 – 2020* also gives a visual representation of the total number of overdose-related deaths for Monroe County. Additional reference to the year 2020 opioid epidemic can be seen in *Figure 56 - Opioid Overdose Deaths in Pennsylvania 2020* which is compared to *Figure 57 - Opioid Overdose Deaths in Pennsylvania 2019* for visualization of the increase that occurred across the Commonwealth.

The most common age group to use opioids are the individuals that fall in the 20-29 years of age range in Monroe County. The 20-29 years of age category has had 597 total overdoses from the year 2016 – 2021. This age group could potentially be the highest number of overdoses related to drugs due to this being the age of a typical college student. The use of Narcan on overdoses was the highest in the year 2020 at ninety uses, along with the highest number of coroner responses at thirty. All this and more information about overdose-related deaths is seen in *Table 63 – Overdose Total by Sex, Narcan Used, and Coroner Response for Monroe County.*

Table 62 - Overdose Total by Municipality for Monroe County

Overdose Total by Municipality for Monroe County							
Municipality	**2016 Total**	**2017 Total**	**2018 Total**	**2019 Total**	**2020 Total**	**2021 Total**	**Municipality Total**
Barrett Township	11	12	9	11	8	1	52
Chestnuthill Township	27	24	35	40	43	5	174
Coolbaugh Township	48	48	48	37	50	5	236
Del Water Gap Borough	4	2	5	0	6	0	17
East Stroudsburg Borough	17	31	34	37	44	3	166
Eldred Township	4	7	6	5	5	2	29
Hamilton Township	21	24	28	17	24	5	119
Jackson Township	8	14	10	7	13	1	53
Lehman Township	27	13	29	21	10	5	105
Middle Smith field Township	37	35	26	49	38	4	189
Mount Pocono Borough	11	9	12	14	14	1	61
Paradise Township	7	4	12	3	12	3	41

Municipality	2016 Total	2017 Total	2018 Total	2019 Total	2020 Total	2021 Total	Municipality Total
Pocono Township	33	24	32	40	43	7	179
Polk Township	13	16	23	11	14	2	79
Price Township	5	7	5	8	10	0	35
Ross Township	13	8	11	8	8	2	50
Smithfield Township	13	9	9	9	27	7	74
Stroud Township	45	26	41	42	43	7	204
Stroudsburg Township	31	25	39	42	38	5	180
Tobyhanna Township	22	12	22	12	30	5	103
Tunkhannock Township	8	19	17	19	16	2	81
Unknown	4	1	6	8	1	0	19
Year Total	**409**	**370**	**459**	**439**	**497**	**72**	**2246**

Table 63 - Overdose Total by Sex, Narcan Used, and Coroner Response for Monroe County

Overdose Total by Age, Sex, Narcan Used, and Coroner Response for Monroe County							
Age	**2016 Total**	**2017 Total**	**2018 Total**	**2019 Total**	**2020 Total**	**2021 Total**	**Total**
0-9	2	4	7	1	6	1	21
10-19	41	38	36	37	35	2	189
20-29	115	106	135	123	108	10	597
30-39	69	58	88	95	124	18	452
40-49	45	32	45	40	50	11	223
50-59	43	38	37	40	55	5	218
60-69	22	14	16	25	24	6	107
70-79	11	8	7	4	8	1	39
80-89	6	2	2	4	2	3	19
Unknown	55	70	86	70	85	15	381
Sex							
Male	180	168	235	248	479	45	1155
Female	219	187	205	174	199	24	1008
Unknown	10	15	19	17	19	3	83
Narcan Used							
Narcan	0	0	2	47	90	14	153
Coroner Response							
Coroner	0	0	11	14	30	0	55

Figure 55 - Monroe County Overdose Death History 2016 - 2020

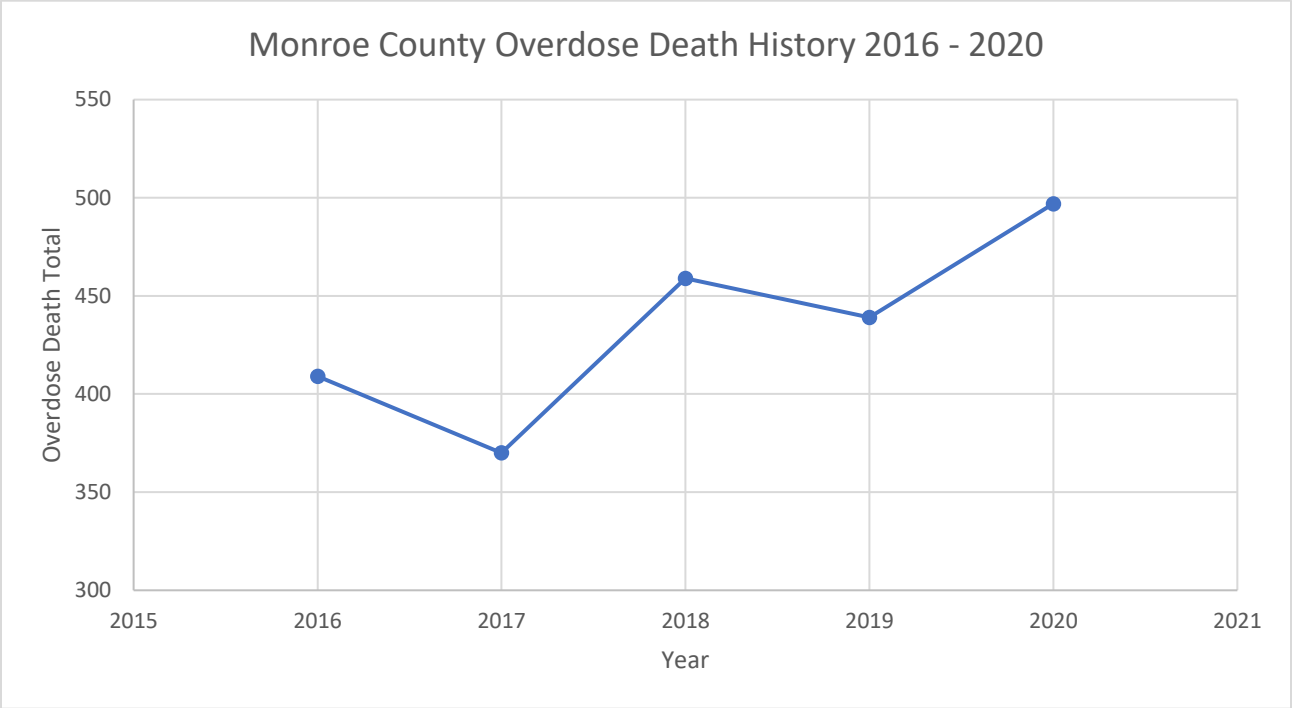


Table 64 - Drugs Present in 2020 Pennsylvania Overdose Deaths

Drugs Present in 2020 PA Overdose Deaths (DEA, 2020)	
Drug Category	**Percent Reported Among 2020 Decedents**
Cannabis	25%
Cocaine	20%
Heroin	15%
Fentanyl	14%
Methamphetamine	10%
Prescription Opioids	5.5%
Cathinones	5.5%
Benzodiazepines	5%

Figure 56 - Opioid Overdose Deaths in Pennsylvania 2020

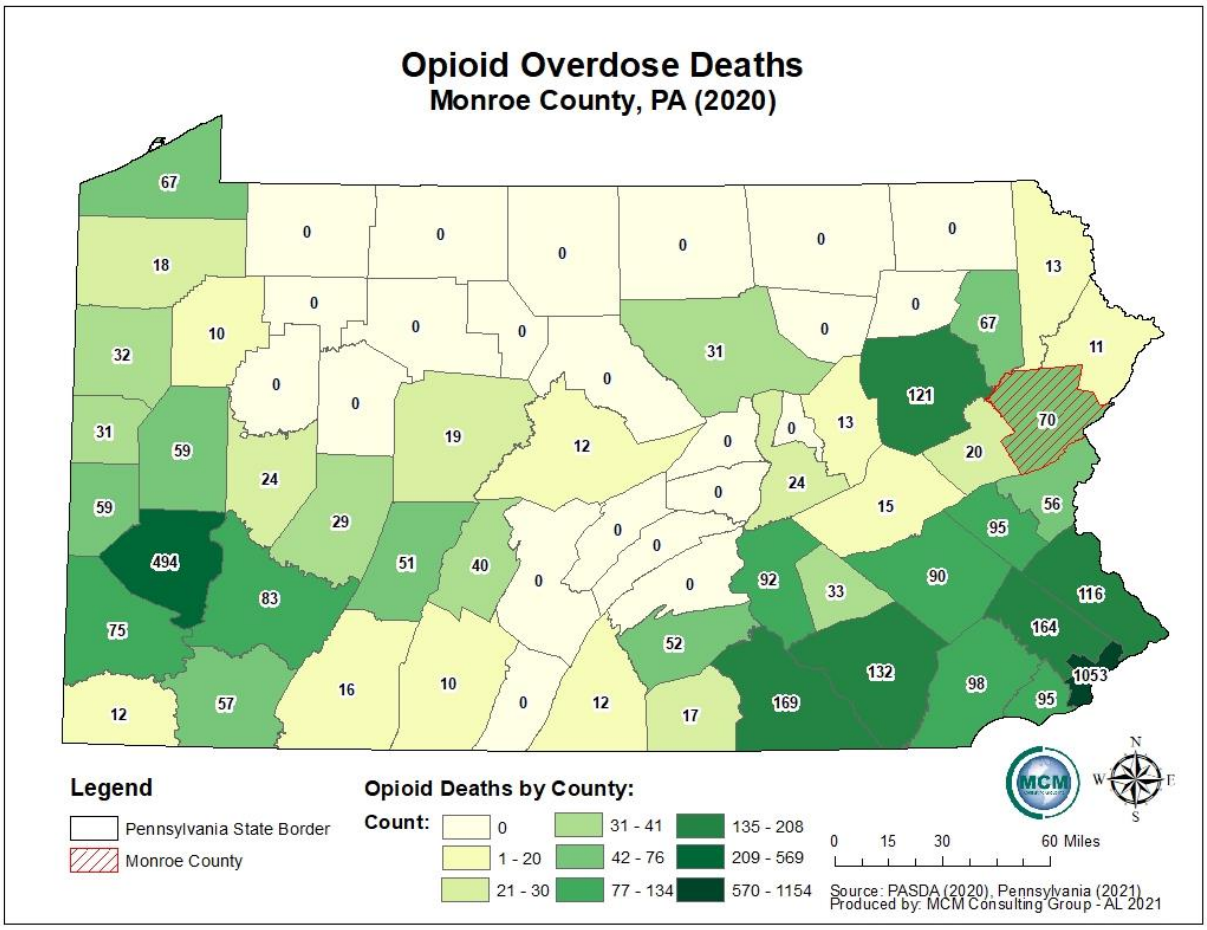
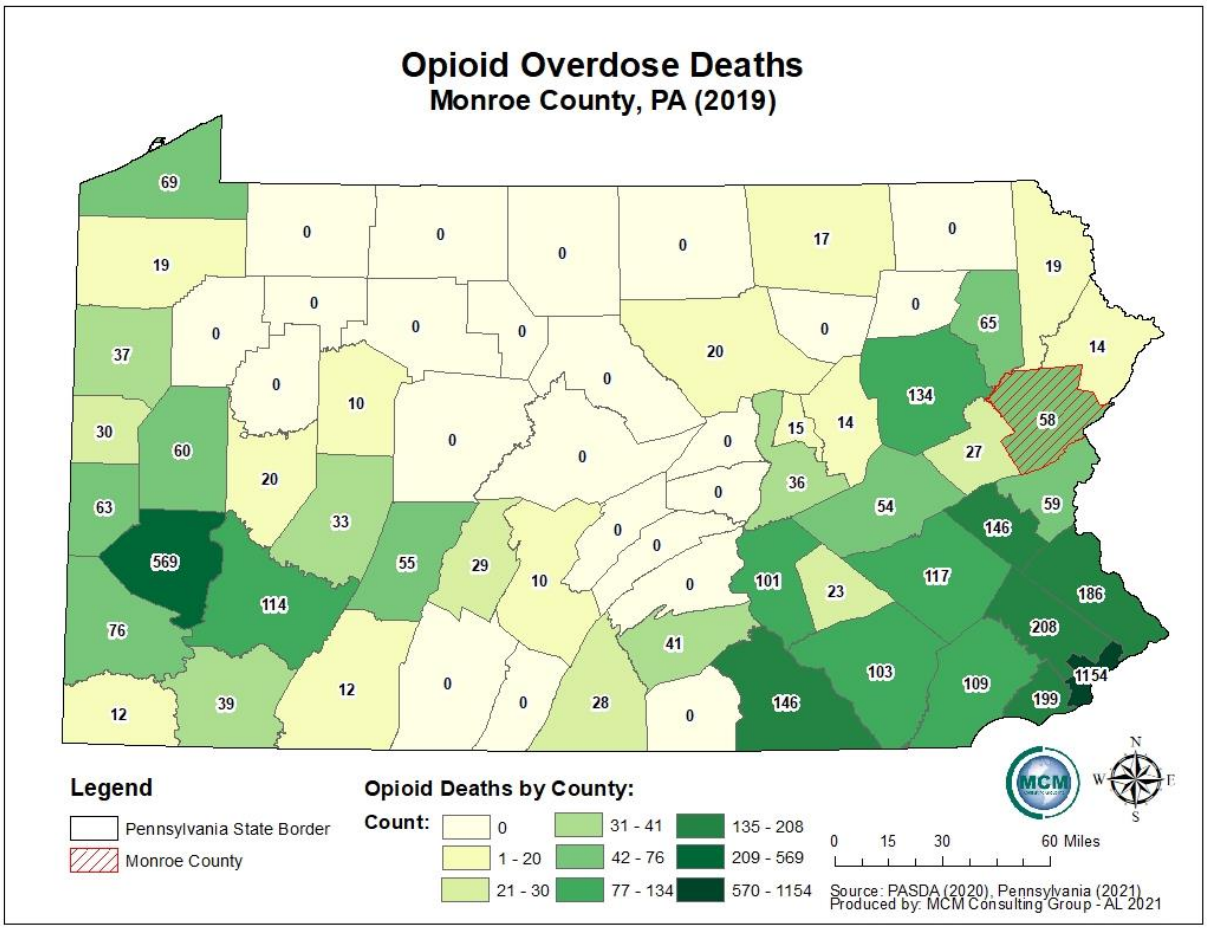


Figure 57 - Opioid Overdose Deaths in Pennsylvania 2019



4.3.17.4 Future Occurrence

Both Monroe County, and Pennsylvania as a whole, have seen a steady rise in opioid-related deaths over the last several years, with drug-related death rates increasing 102%. Future occurrences of opioid addiction and overdose are unclear as the state moves forward with overdose prevention initiatives through the use of Naloxone, alternative pain treatments, improvement of tools for families and first responders, and expansion of treatment access.

In the event of an opioid overdose, death can sometimes be prevented with the use of the drug naloxone. Naloxone is a medication used to block the effects of opioid and is sold under the brand name of Narcan. Emergency medical responders have access to the treatment, and as of 2015, naloxone is available without a prescription in Pennsylvania. In *Table 63 – Overdose Total by Sex, Narcan Used, and Coroner Response for Monroe County*, a portion of the table indicates how many times Naloxone was used for prevention in Monroe County. Also, with the January

10, 2018 disaster declaration, emergency medical technicians (EMTs) are now allowed to leave naloxone behind at a scene, further increasing the distribution and accessibility of the lifesaving medication. According to a study published in September 2018, drug users reported that users often have multiple overdoses in the course of their drug use, and availability of naloxone has saved many lives. While the introduction of naloxone has been a significant benefit to the fight against opioid abuse, efforts to prevent future overdoses are still underway.

Rather than reduce pain, in some cases high doses of opioid painkillers can increase pain due to a phenomenon known as opioid-induced hyperalgesia (OIH). It is difficult to know how much of an influence OIH has on the opioid epidemic. Some researchers think that OIH could be increasing patients' pain and in turn, increasing their dosages and dependence on opioid drugs, suggesting that patients should work with lower dosages of opioids. However, other researchers are unsure of the importance of OIH for opioid users.

Opioid drugs have been a problematic and addictive solution for patients to deal with pain. Employing alternative approaches to pain management could prevent patients from ever being introduced to addictive opioids, especially considering the most common overdose drugs in Monroe County have been prescription opioids. A possible alternative pain treatment comes from hemp extracted cannabidiol, or CBD. Unlike THC (the psychoactive constituent of cannabis) CBD is non-psychoactive and does not have the same intoxicating effect as THC; however, CBD can provide relief from pain, inflammation, anxiety, and even psychosis. CBD is legal without a prescription throughout the United States of America.

4.3.17.5 Vulnerability Assessment

Opioid overdoses have resulted in many tragic deaths in Pennsylvania and many people have been affected by the epidemic through the loss of either a family member, a close friend, or member of their community. Opioid addiction is a direct detriment to the personal well being of addicts, a burden to their families and communities, and a strain to the emergency response system that cares for overdose victims.

While opioid addiction is often viewed as a criminal problem, a more productive way to view the epidemic can be to view opioid addiction as a chronic disease. This paradigm shift moves away from faulting the abuser and incentivizing quick cures, to viewing the abuser as a patient and working towards long-term management of the disease. In general, it is important to consider alternative approaches to pain treatment in order to avoid beginning a dependence on highly addictive prescribed opioids.

Fentanyl and related substances are hazardous materials and should be treated as such, which causes the environment and the people around the substance to be vulnerable. Contact with fentanyl can impact first responders and others that are related to the opioid user. Depending on

the potency of the drug, it can take as little as the equivalent of few grams of table salt to cause health complications. There have been several reports nationally of first responders accidentally overdosing on fentanyl or carfentanyl through brief skin contact or the drug becoming airborne. It is best for first responders to err on the side of caution to avoid any potential exposure. The American College of Medical Toxicology (ACMT) and the American Academy of Clinical Toxicology (AACT) suggest that nitrile gloves provide sufficient protection for handling fentanyl, and for "exceptional circumstances where the drug particles or droplets suspended in the air, an N95 respirator provides sufficient protection". Other environmental structures such as streams, rivers, and lakes have been known to contain traces of opioids and other drugs within them. These traces come from human urine, feces, or medications that have been discarded in the bathroom. The Environmental Protection Agency (EPA) suggests that while the risks of pharmaceuticals found in wastewater, ambient water, and drinking water are low, further research is needed. State facilities are not at risk to the opioid crisis, but there are some occupation-specific risks that may make some employees more vulnerable. State employees working in direct patient care are vulnerable to fentanyl exposure. However, the physical plant and facilities of the Commonwealth and Monroe County are not likely to experience losses from the opioid addiction crisis. Absenteeism associated with an opioid addiction in state facilities located in high-risk areas could lead to economic loss through lost productivity and increased medical costs.

4.3.18. Terrorism/Cyber Terrorism/Incidents

4.3.18.1 Location and Extent

Following several serious international and domestic terrorist incidents during the 1990s and early 2000s, citizens across the United States paid increased attention to the potential for deliberate, harmful actions of individuals or groups. The term "terrorism" refers to intentional, criminal, malicious acts. The functional definition of terrorism can be interpreted in many ways. Officially, terrorism is defined in the Code of Federal Regulations as "…the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." (28 CFR §0.85)

Cyber-terrorism is the unlawful use of force and violence over technological methods to cause harm to financial security, identity information, personal information, and attacking personal computers, mobile phones, gaming systems, and other Bluetooth or wirelessly connected devices. Cyber-terrorism can be just as damaging to infrastructure as conventional terrorism, due to the large amount of business that is carried out over the internet, through wirelessly connected devices, or from employees of companies working remotely.

The Federal Bureau of Investigations (FBI) further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. Often, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and the consequences. However, it is important to consider that the prevalence of homegrown violent extremists (HVE's) has increased in recent years, with individuals able to become radicalized on the internet. In a speech on August 29, 2018 addressed to the 11th annual Utah National Security and Anti-Terrorism Conference, FBI Director Christopher Wray describes HVE's as "the primary terrorist threat to the homeland here today, without question."

Critical facilities are either in the public or private sector that provide essential products and/or services to the general public. Critical facilities are often necessary to preserve the welfare and quality of life in the county, or fulfill important public safety, emergency response, and/or disaster recovery functions. Critical facilities identified in the county are hospitals and health care facilities, schools, childcare centers, fire stations, police departments, municipal buildings, and hazardous waste facilities.

In addition to critical facilities, the county contains at risk populations that should be factored into a vulnerability assessment. These populations include not only the residents and workforce in the county, but also the tourists that visit the area on a daily basis, those that are traveling through the county on any major highway and marginalized groups such as LGBTQ persons and racial minorities.

Potential targets include:

- Commercial facilities
- Family planning clinics/organizations associated with controversial issues
- Education facilities
- Events attracting large amounts of people
- Places of worship
- Industrial facilities, especially those utilizing large quantities of hazardous materials
- Transportation infrastructure
- Historical Sites
- Government facilities

4.3.18.2 Range of Magnitude

Terrorism may include use of Weapons of Mass Destruction (WMD) (including biological, chemical, explosive, nuclear, and radiological weapons) which include arson, incendiary, explosive, armed attacks, industrial sabotage, intentional release of hazardous materials, and cyber-terrorism. Within these general categories, there are many variations. There is a wide

variety of agents and ways for them to be disseminated, particularly in the case of biological and chemical weapons.

Terrorist methods can take many forms including:

- Active assailant
- Agri-terrorism
- Arson/incendiary attack
- Armed attack
- Assassination
- Biological agent
- Chemical agent
- Cyber-terrorism
- Conventional bomb or bomb threat
- Hijackings
- Release of hazardous materials
- Kidnapping
- Nuclear bomb
- Radiological agent

Active assailant incidents and threats can disrupt the learning atmosphere in schools, interfere with worship services, cause traffic to be re-routed, and uses taxpayer assets from deploying police, EMS and/or fire units. Monroe County has four school districts (public schools K through 12th grade), several private schools and the Monroe County Area Vocational Technical School.

The areas along major transportation routes can be susceptible to forms of public transit terrorist attacks. More populated areas of the county, including the county seat of Stroudsburg, can be susceptible to chemical, biological, radiological, nuclear, or explosive (CBRNE) events due to the concentration and density of residential communities and government activity and buildings. Secondary effects from CBRNE incidents can be damaging as well. Mass evacuations could result in congestion of roadways and possibly result in breakdown of civil order, further exacerbating the situation. Government operations may be disrupted due to the need to displace or operate under reduced capacity. Radiation fallout, hazardous chemical introduction into the groundwater or biologic/germ agents can cause long-term environmental damage.

Cyber terrorism is becoming increasingly prevalent. Cyber terrorism can be defined as activities intended to damage or disrupt vital computer systems. These acts can range from taking control of a host website to using networked resources to directly cause destruction and harm. Protection of databases and infrastructure are the main goals for a safe cyber environment. Cyber terrorists can be difficult to identify because the internet provides a meeting place for individuals from

various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. The largest threat to institutions from cyber terrorism comes from any processes that are networked or controlled via computers.

Ransomware continues to be the leading threat, with Maze ransomware accounting for nearly half of all known cases in 2020. Cybercriminals have increasingly begun to steal proprietary – and sometimes embarrassing – data before encrypting it. The cybercriminal will then threaten to publicly release the stolen files if the victims do not provide financial transactions.

4.3.18.3 Past Occurrence

There have been no physical terrorist attacks in Monroe County, to date.

An active assailant (shooter), as defined by the U.S. Department of Homeland Security, is an individual actively engaged in killing or attempting to kill people in a confined area, in most cases, active shooters use firearms and there is not necessarily a pattern or method to their selection of victims. Throughout the year in 2020, there were a total of twenty-eight mass shooting incidents in the United States according to the FBI. Often these shooters are homegrown violent extremists (HVE's). Two significant events have occurred in Pennsylvania in recent history: one occurred on October 27, 2018, where eleven people were killed by a gunman in the Pittsburgh neighborhood of Squirrel Hill; the gunman was a homegrown violent extremist and attacked the congregation of the Tree of Life Synagogue in a shooting that targeted the Jewish population and was fueled by the gunman's anti-Semitic, anti-immigrant, and anti-refugee sentiments. Another event occurred in January of 2019, where a gunman killed two people and permanently injured one inside P.J. Harrigan's bar in State College and later killed a homeowner and himself.

There have also been a number of active shooter events in the United States in recent years and they include those that occurred at Virginia Tech (April 2007), Sandy Hook Elementary School (December 2012), San Bernardino, California (December 2015), an Aurora, Colorado movie theater (July 2012) and a church in Charleston, South Carolina (June 2015). A 2014 study by the FBI concluded that there has been a significant recent increase in frequency of active shooter incidents, and that the vast majority (154 of 160 shooters between 2000 and 2013) were male (FBI, 2014). Of these 160 incidents, 45.6% took place in commercial environments, 24.3% took place in an educational environment, and the remaining 30.1% took place at other locations such as open spaces, military and other government properties, residential locations, houses of worship, and health care facilities (FBI, 2019). The annual report on the study may be found here: https://www.justice.gov/usao-mdpa/page/file/1272096/download. *Figure 58 – Active Shooter Incidents 2000 – 2018* illustrates a numerical breakdown of shooting events for those eighteen years.

Figure 58 - Active Shooter Incidents 2000 - 2018 (FBI, 2019)

Significant international terrorism incidents in the United States include the World Trade Center bombing in 1993, the bombing of the Murrow Building in Oklahoma City in 1995, and the September 11th, 2001 attacks on the World Trade Center and the Pentagon. One of the aircrafts hijacked in the September 11th attacks crash landed in Somerset County, Pennsylvania before it reached its intended target. While fatalities and destruction at the intended target were avoided, all passengers on the flight perished.

While the largest scale terrorist incidents have often had international stimuli, many other incidents are caused by home grown actors who may have become radicalized through hate groups either in real life or via the internet, and who may struggle with mental health issues. Hate groups such as the Ku Klux Klan (KKK), Aryan Nation, and more recently, the Alt-Right, Antifa, Proud Boys, plus conspiracy theorist believers/promoters such as QAnon, have been part of domestic terrorism in different forms. Supporters of former President Donald Trump from one or more of these groups stormed the United States Capitol on January 6, 2021, to disrupt the certification of the 2020 presidential election, resulting in five deaths and evacuation of Congress.

Knowledge Center reports of terrorist activity in Monroe County as of March 2021 can be found in *Table 65 – Terrorist Activity History*; however, these incidents are not all inclusive of the

history of terrorism, nor are they necessarily real terrorism as defined by the FBI. Entries vary due to recorder's selection of category and description.

Figure 59 – Monroe County Terrorism Events by Municipality illustrates the count of terrorism events per municipality for the entire county.

Table 65 - Terrorist Activity History

Terrorist Activity History 2009 – 2020			
Title	**Location**	**Location Type**	**Date**
Suspicious Package	Pocono	Township	09/25/2009
Bomb Threat	East Stroudsburg	Borough	10/06/2009
Bomb Threat	Smithfield	Township	01/27/2010
Suspicious Package	Pocono	Township	05/18/2010
Bomb Threat	Stroud	Township	05/19/2010
Bomb Scare	East Stroudsburg	Borough	09/28/2010
Pipe Bomb Explosion	Stroud	Township	03/22/2011
Car Bomb	Stroud	Township	04/07/2011
Suspicious Package	Pocono	Township	07/26/2011
Bomb Threat	Mt Pocono	Borough	09/04/2011
Bomb Threat	Stroud	Township	10/20/2012
Bomb Threat	East Stroudsburg	Borough	10/30/2012
Bomb Scare	Tobyhanna	Township	03/07/2013
Suspicious Package	Mt Pocono	Borough	05/06/2013
Bomb Threat	East Stroudsburg	Borough	06/18/2013
Active Shooter	Ross	Township	08/05/2013
Bomb Threat	Chestnuthill	Township	05/15/2016
Suspicious Package	Stroud	Township	04/18/2017
Suspicious Device Found	Stroud	Township	05/12/2017
Suspicious Package	Tobyhanna	Township	12/15/2017
School Bomb Threat	Chestnuthill	Township	02/12/2018
Bomb Threat	Mt Pocono	Borough	03/17/2018
Bomb Threat	-	-	05/07/2018
Bomb Threat	Stroudsburg	Borough	06/11/2018
Bomb Threat	Stroudsburg	Borough	07/09/2018
Suspicious Package	Hamilton	Township	09/26/2018
Bomb Threat	-	-	10/01/2018
Bomb Threat at Monroe County Courthouse	Stroudsburg	Borough	10/02/2018

Title	Location	Location Type	Date
Bomb Threat at Monroe County Courthouse	Stroudsburg	Borough	11/02/2018
Bomb Threat at Monroe County Courthouse	Stroudsburg	Borough	11/06/2018
Email Bomb Threat	Stroudsburg	Borough	12/13/2018
Bomb Threat	Pocono	Township	05/10/2020
Bomb Threat	Stroud	Township	07/20/2020
Explosive Device Found	Tobyhanna	Township	11/15/2020
Source: Knowledge Center (2021)			

4.3.18.4 Future Occurrence

The likelihood of Monroe County being a primary target for a major international terrorist attack is small and unlikely. More likely terrorist activity in Monroe County includes bomb threats or other incidents at schools. Monroe County has four school districts consisting of twenty-eight public schools. The East Stroudsburg University of Pennsylvania and the Monroe Campus of Northampton Community College also exist in Monroe County. Despite the fact that only one entry in *Table 65 – Terrorist Activity History* is listed as a school bomb threat, some of the other events may have occurred at educational facilities but simply don't have enough information about them provided in the Knowledge Center data.

4.3.18.5 Vulnerability Assessment

Monroe County should stay prepared for terrorism type incidents. The existence of industrial commerce, interstate highways and freight railroad activity create soft targets that could be used to interfere with the focus of day-to-day life that the county experiences. It is important to note that the use and exposure to biological agents can remain unknown for several days until the infected person(s), livestock, or crops begin to experience symptoms or show damages. Often such agents are contagious, and the infected person(s) must be quarantined, livestock culled, and/or crops destroyed.

Although previous events have not resulted in what are considered significant terrorist attacks, the severity of a future incident cannot be predicted with a total level of certainty. One of the major concerns with agroterrorism is that acts can be carried out with minimal planning, effort, or expense (CBRNE Terrorism Newsletter, 2013).

The Acronis Cyberthreats Report 2020 contains an in-depth review of the current threat landscape and projections for the coming year. Based on the protection and security challenges that were amplified by the shift to remote work during the COVID-19 pandemic, Arconis warns

2021 will bring aggressive cybercrime activities as criminals pivot their attacks from data encryption to data exfiltration.

The major points illustrated in the report are as follows:

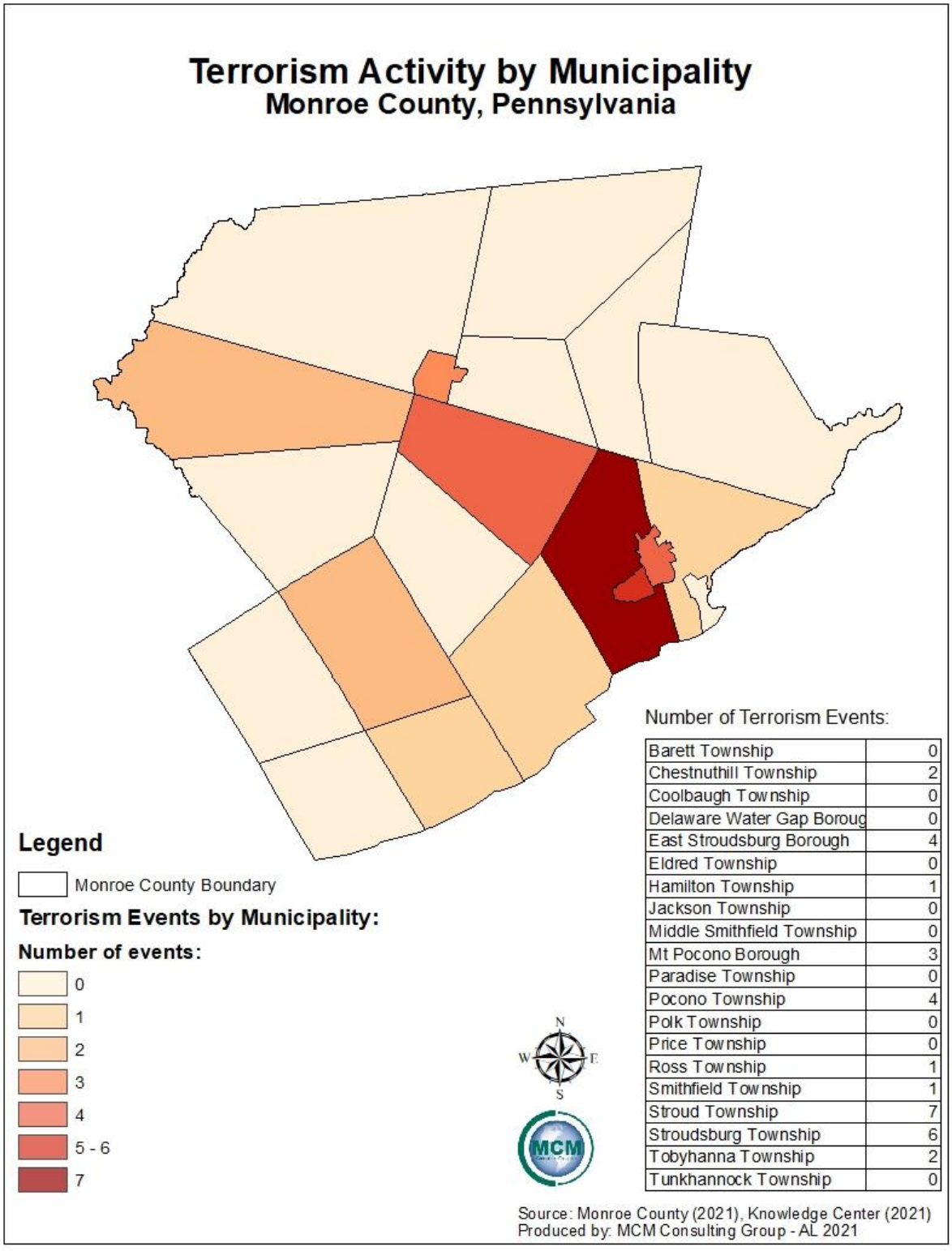
- Attacks against remote workers will increase due to the movement of workers to less secure working areas.
- Ransomware will look for new victims and will become more automated.
- Legacy IT and technical solutions will struggle to keep pace with ransomware and cybercrime attacks.

According to a study carried out on the data sourced from the Federal Bureau of Investigation, Pennsylvania is ranked second worst among states when it comes to handling cyber-attacks. The study made by Information Network Associates – an international security consulting company – says an increase of 25% was witnessed in cyber-attacks between 2016 and 2017. This illustrates the amount of preparation that must occur in the Commonwealth so that it can better respond to potential cybercrime attacks.

The probability of terrorist activity is more difficult to quantify than some other hazards. Instead of considering the likelihood of occurrence, vulnerability is assessed in terms of specific assets. By identifying potentially at-risk terrorist targets in communities, planning efforts can be put in place to reduce the risk of attack. Planning should work towards identifying potentially at-risk critical infrastructure and functional needs facilities in the community, prioritizing those assets and locations, and identifying their vulnerabilities relative to known potential threats.

All communities in Monroe County are vulnerable on some level, directly or indirectly, to a terrorist attack. However, communities with schools and government infrastructure like the county seat, should be considered more likely to attract terrorist activity.

Figure 59 - Monroe County Terrorism Events by Municipality



4.3.19. Transportation Accidents

4.3.19.1 Location and Extent

Transportation accidents will claim more lives annually and cause more injuries than any other hazard. With rail, air, and highway transportation available all over Pennsylvania, every county in the Commonwealth is susceptible to this hazard.

Highways

There are 1,344.8 miles of developed roads in Monroe County; with interstate highways accounting for 40.4 miles of this total, while 487.9 miles are state and US highways. Significant transportation routes such as Interstate 380 and Interstate 80, US 209, P 115, 447, 33 and 611 intersect the county. According to Pennsylvania Department of Transportation (PennDOT) there are 366 bridges on state roads in Monroe County and sixty bridges on local roads.

Railways

One railroad line, owned by Pennsylvania Northeast Regional Railroad Authority, transports freight of all types in Monroe County. The rail line runs generally northwest to southeast. The Pennsylvania Northeast Regional Railroad Authority (PNRRA) was formed in 2006 by Monroe and Lackawanna counties. According to the Monroe County Comprehensive Plan (December 2014) "the majority of rail freight enters into the county as raw material and leaves as finished product by truck".

There has been an ongoing project to restore passenger rail service between Scranton, PA and Hoboken, NJ. According to the 2014 Monroe County Comprehensive Plan, funding had not been secured for the second phase, Andover to Delaware Water Gap, or for the third phase between Delaware Water Gap to Scranton.

Rail accidents can be divided into the following categories:

- Derailment – one or more cars of the train leaves the rails.
- Collision – a train strikes another train or a vehicle.
- Other – including striking objects on the rails (to include pedestrians), fires, or explosions.

Aviation

There are four airports in the county: Pocono Mountain Municipal Airport, Stroudsburg-Pocono Airport, Flying Dollar Airport, and Pegasus Airpark (See *Figure 61- Airport Vulnerability Map)*. The Pocono Mountain Municipal Airport, owned by the Pocono Mountain Municipal Airport Authority, is a public airport located two miles northwest of Mount Pocono, Tobyhanna. Stroudsburg-Pocono Airport is a privately owned, public use airport located east of Stroudsburg.

Flying Dollar Airport is a privately owned, public-use airport that was formerly Barrett Airport and is the oldest airport in the Poconos.

Aviation accidents are often devastating incidents that may result in serious injuries or fatalities. The Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB) are responsible for monitoring air travel and investigating accidents. Some of the most common causes of aviation accidents occur because of violations to FAA and NTSB regulations. Some other causes of accidents include, but are not limited to:

- Pilot or flight crew errors – Pilot error is the number-one cause of aviation accidents and accounts for the highest number of fatalities.
- Faulty equipment – Faulty aircraft equipment or mechanical features is another common cause of aviation accident.
- Aircraft design flaws – The manufacturer of an aircraft is responsible for an aviation accident if the structural design is flawed and results in an accident.
- Failure to properly fuel or maintain the aircraft – If any regulations and safety standards set by the FAA or NTSB are violated, an accident may occur.
- Negligence of Federal Air Traffic Controllers – Failure of air traffic controllers to properly monitor the airways is another cause of aviation accident.

4.3.19.2 Range of Magnitude

In terms of transportation, the maximum threat to Monroe County is when the incident occurs in or near heavily populated areas. Each mode of public transit experiences accidents on an annual basis across the United States. Each of these modes also can have incidents that occur on small and large scales.

Transportation accidents can result in death or serious injury and extensive property loss or damage. Road and railway accidents have a potential to result in hazardous material releases. Accidents involving hazardous materials pose potential environmental impacts such as air, water, and/or soil contamination.

The more heavily traveled roads experience a higher percentage of automobile accidents, typically due to higher speeds and inclement weather.

Aviation incidents most often occur near landing or take-off sites, as such a two-mile radius around each airport in Monroe County can be considered a high-risk area.

4.3.19.3 Past Occurrence

The most serious transportation concerns in Monroe County involve Interstate 380 and Interstate 80, US Route 209, and PA Route 196 and PA Route 611.

Table 66 – Transportation Accidents in Monroe County are those reported to the Monroe County 911 and entered in the Monroe County Knowledge Center™ (currently Corvena) database between June 25, 2009 and January 26, 2021.

Table 66 - Transportation Accidents in Monroe County

Transportation Accidents in Monroe County		
Date	**Event**	**Municipality**
06/25/2009	Traffic accident	Hamilton Township
06/27/2009	Vehicle accident	Mt. Pocono Borough
07/01/2009	Firefighter vehicle accident	Coolbaugh Township
07/05/2009	Vehicle accident, road closure	Hamilton Township
07/22/2009	Vehicle accident, road closure	Tunkhannock Township
08/02/2009	Vehicle accident with injuries	Hamilton Township
08/22/2009	Vehicle accident	Pocono Township
08/24/2009	Traffic accident with road closure	Middle Smithfield Township
08/30/2009	Airplane crash	Chestnuthill Township
09/11/2009	School bus accident	Tobyhanna Township
10/13/2009	Vehicle accident	Stroud Township
11/06/2009	School bus accident	Eldred Township
11/12/2009	Neola Road bus accident	Jackson Township
11/25/2009	School bus accident	Stroud Township
12/07/2009	School bus accident	Stroud Township
12/13/2009	EMS accident	Hamilton Township
12/26/2009	Tractor trailer accident	Tobyhanna Township
01/11/2010	School bus accident	Coolbaugh Township
01/28/2010	School bus accident	Stroud Township
01/28/2010	Bus accident	Pocono Township
01/28/2010	School bus accident at Route 940 and Long Pond Road	Tobyhanna Township
01/28/2010	Second school bus accident at Rt. 940 and Long Pond Rd.	Tobyhanna Township
02/03/2010	School bus accident	Stroudsburg Borough
02/08/2010	School bus accident	Stroud Township
02/17/2010	School bus accident	Tobyhanna Township
03/25/2010	School bus accident	Tunkhannock Township
03/25/2010	School bus accident	Coolbaugh Township

Date	Event	Municipality
04/03/2010	Ambulance accident	Middle Smithfield Township
04/07/2010	Tractor trailer accident on I-380	Tobyhanna Township
04/07/2010	School bus accident	Stroud Township
04/08/2010	School bus accident	Coolbaugh Township
04/09/2010	School bus accident	Stroud Township
05/17/2010	School bus accident	East Stroudsburg Borough
07/21/2010	Tractor trailer accident	Pocono Township
07/29/2010	Vehicle accident with a fatality	Middle Smithfield Township
08/09/2010	Vehicle accident with road closure	Hamilton Township
08/16/2010	Traffic accident with road closure	Hamilton Township
08/26/2010	Fatal accident	Tobyhanna Township
09/14/2010	Motorcycle accident	East Stroudsburg Borough
09/23/2010	School bus accident	Stroud Township
09/27/2010	School bus accident	Coolbaugh Township
10/09/2010	School bus accident	Stroudsburg Borough
10/16/2010	School bus accident	Tobyhanna Township
10/18/2010	School bus accident	Ross Township
10/29/2010	School bus accident	Chestnuthill Township
10/29/2010	School bus accident	Stroudsburg Borough
11/11/2010	Vehicle accident with a fatality	Tobyhanna Township
11/17/2010	School bus accident	Stroudsburg Borough
12/03/2010	Vehicle accident with fuel spill	Chestnuthill Township
12/03/2010	Bus accident at the Stroud Mall	Stroud Township
12/09/2010	Bus accident	Stroudsburg Borough
12/09/2010	School bus accident	Stroud Township
12/27/2010	Penn Dot truck accident	Tunkhannock Township
12/29/2010	Vehicle accident with a pedestrian	East Stroudsburg Borough
01/01/2011	Vehicle accident with a fatality	Chestnuthill Township
01/14/2011	School bus accident	Stroudsburg Borough
01/21/2011	Vehicle accident with a pedestrian	Paradise Township
01/24/2011	School bus accident	Smithfield Township
02/04/2011	School bus accident	Coolbaugh Township
02/10/2011	School bus accident	Eldred Township
02/11/2011	School bus accident	Pocono Township

Date	Event	Municipality
02/15/2011	Vehicle accident	Mt. Pocono Borough
02/28/2011	School bus accident	Stroud Township
03/01/2011	School bus accident	Coolbaugh Township
03/03/2011	Vehicle accident with a fatality	Chestnuthill Township
03/15/2011	Ambulance accident	Chestnuthill Township
03/18/2011	School bus accident	East Stroudsburg Borough
03/23/2011	Ambulance accident	Tobyhanna Township
03/25/2011	School bus accident	Pocono Township
04/11/2011	School bus accident	Polk Township
04/14/2011	School bus accident	Middle Smithfield Township
05/04/2011	School bus accident	Tobyhanna Township
05/13/2011	EMS unit involved in an accident	Stroud Township
05/23/2011	Vehicle accident	Tunkhannock Township
06/03/2011	Tractor trailer accident	Pocono Township
06/09/2011	School bus accident	Stroud Township
07/18/2011	Ambulance accident	Middle Smithfield Township
09/12/2011	School bus accident	Chestnuthill Township
09/20/2011	School bus accident	Coolbaugh Township
09/26/2011	School bus accident	Hamilton Township
09/27/2011	School bus accident	Mt. Pocono Borough
09/30/2011	School bus accident	Pocono Township
10/03/2011	School bus accident	Hamilton Township
10/07/2011	Truck accident on Treible Road	Chestnuthill Township
10/13/2011	School bus accident	Eldred Township
12/19/2011	School bus accident	East Stroudsburg Borough
01/21/2012	Ambulance accident	Jackson Township
02/01/2012	School bus accident	Coolbaugh Township
02/06/2012	School bus accident	Mt. Pocono Borough
03/03/2012	Motorcycle accident	Tobyhanna Township
03/16/2012	School bus accident	Chestnuthill Township
03/21/2012	School bus accident	Coolbaugh Township
04/23/2012	School bus accident	Jackson Township
04/24/2012	Tractor trailer accident	Stroudsburg Borough
05/01/2012	Fatal motorcycle accident	Pocono Township

Date	Event	Municipality
07/01/2012	Vehicle accident	Tobyhanna Township
07/29/2012	Major traffic accident closing I-80	Stroud Township
08/01/2012	Bus accident	Polk Township
08/31/2012	Aircraft accident	Paradise Township
09/12/2012	School bus accident	Chestnuthill Township
09/14/2012	Bus accident	Chestnuthill Township
09/19/2012	School bus accident	Tobyhanna Township
09/21/2012	School bus accident	Smithfield Township
10/02/2012	School bus accident	Stroud Township
10/03/2012	School bus accident	Ross Township
10/17/2012	Tractor trailer accident	Stroud Township
01/25/2013	School bus accident	East Stroudsburg Borough
02/04/2013	Tour bus accident on I-380 at mile marker 2.3	Pocono Township
02/19/2013	Bus accident	Tobyhanna Township
02/20/2013	Ambulance accident with entrapment	Stroud Township
04/08/2013	Accident between a school bus and a motorcycle	Pocono Township
04/12/2013	Pleasant Valley School bus accident	Chestnuthill Township
05/22/2013	School bus accident	Stroudsburg Borough
06/03/2013	School bus accident	Middle Smithfield Township
06/19/2013	Accident between a school bus and motorcycle	Delaware Water Gap Borough
09/07/2013	Fatal motorcycle accident	Pocono Township
10/28/2013	School bus crash	Monroe County
11/04/2013	Minor accident involving a Pocono Mt. School bus	Tunkhannock Township
12/19/2013	School bus accident	Stroudsburg Borough
12/23/2013	Vehicle accident with six injured.	Coolbaugh Township
12/27/2013	Vehicle accident	Pocono Township
12/30/2013	Vehicle accident involving a Polk Twp. firefighter	Polk Township
01/06/2014	School bus accident	Smithfield Township
01/23/2014	School bus accident, 29 students evaluated by EMS	East Stroudsburg Borough
03/03/2014	School bus accident	Stroud Township
03/05/2014	Pike County Transportation Bus accident with a car	Monroe County
03/13/2014	Ambulance accident I-80 WB MM 296.4	Pocono Township
03/15/2014	Accident involving a PSP vehicle	Unknown location
03/17/2014	School bus accident	Hamilton

Date	Event	Municipality
03/28/2014	School bus accident	Stroud Township
04/20/2014	Tractor trailer accident on I-380 NB MM 8.1	Coolbaugh Township
05/27/2014	School bus accident with no injuries	Pocono Township
06/04/2014	Vehicle accident with I-80 closure	Stroud Township
06/06/2014	School bus accident, 10 students with no injuries	Stroud Township
06/09/2014	Stroudsburg Area school bus accident	Monroe County
07/20/2014	Fatal ATV accident	Chestnuthill Township
07/27/2014	Motorcycle accident on Route 209	Monroe County
07/28/2014	Vehicle accident Route 115	Monroe County
08/21/2014	Plane crash	Chestnuthill Township
08/23/2014	Vehicle accident with oil spill on Route 196	Monroe County
09/02/2014	Accident with fire that closed I-80	Hamilton Township
10/13/2014	School bus accident	Stroud Township
10/29/2014	Accident involving PSP	Mt. Pocono Borough
11/06/2014	Vehicle accident	Polk Township
01/04/2015	PSP accident	Jackson Township
01/22/2015	Accidents due to icy roads	Monroe County
01/28/2015	School bus accident	Unknown location
02/26/2015	Bus accident	East Stroudsburg Borough
02/27/2015	School bus accident with no injury	East Stroudsburg Borough
05/16/2015	Accident on I-80 with injury	Pocono Township
05/21/2015	Vehicle accident with multiple patients	Polk Township
06/03/2015	Accident on I-380	Coolbaugh Township
06/06/2015	Vehicle accident with several trapped	Hamilton Township
06/27/2015	Vehicle accident with entrapment	Hamilton Township
08/01/2015	Motorcycle vs. van accident	Stroud Township
08/14/2015	Vehicle accident with entrapment and fire	Coolbaugh Township
10/15/2015	School bus accident	Jackson Township
10/23/2015	School bus accident	Stroudsburg Borough
10/27/2015	Accident with road closure	Stroudsburg Borough
10/28/2015	EMS involved vehicle accident	Stroudsburg Borough
11/01/2015	Vehicle accident with road closure	Pocono Township
11/02/2015	School bus accident	Pocono Township
11/03/2015	Fatal train incident	Stroud Township
11/05/2015	Vehicle accident with road closure	Coolbaugh Township
11/06/2015	School bus accident	Tobyhanna Township

Date	Event	Municipality
11/07/2015	Pedestrian involved accident with road closure	Monroe County
11/07/2015	Vehicle accident with entrapment	Tobyhanna Township
11/07/2015	Vehicle vs. deer accident with road closure	Coolbaugh Township
11/12/2015	School bus accident	Tobyhanna Township
11/13/2015	Vehicle accident with interstate closure	Tobyhanna Township
11/13/2015	Bus accident	Stroudsburg Borough
11/15/2015	Tractor-trailer rollover	Monroe County
11/17/2015	Vehicle accident with road closure	Barrett Township
11/18/2015	Vehicle accident	Smithfield Township
11/29/2015	Vehicle accident involving an ambulance	Pocono Township
12/01/2015	Fatal vehicle accident with road closure	Chestnuthill Township
12/06/2015	Fatal vehicle accident with road closure	Smithfield Township
12/13/2015	Fatal vehicle accident with road closure	Chestnuthill Township
12/15/2015	Vehicle accident on Route 196 with road closure	Coolbaugh Township
12/18/2015	Vehicle accident	Monroe County
12/31/2015	Pedestrian involved accident	Monroe County
01/05/2016	Vehicle accident with road closure	Stroud Township
01/06/2016	School bus accident	Polk Township
01/07/2016	Vehicle accident with road closure	Stroud Township
01/09/2016	Vehicle accident with road closure	Smithfield Township
01/12/2016	Vehicle accident involving an ambulance	Tobyhanna Township
01/12/2016	School bus accident	Barrett Township
01/15/2016	Vehicle accident with Route 33 closure	Ross Township
01/23/2016	Bus accident on Route 611	Pocono Township
02/09/2016	Vehicle accident involving a police vehicle	Tobyhanna Township
02/12/2016	Vehicle accident with road closure	Coolbaugh Township
02/15/2016	Ambulance accident	Monroe County
02/19/2016	Vehicle accident with road closure	Stroud Township
02/25/2016	Vehicle accident with entrapment	Mt. Pocono Borough
02/26/2016	Vehicle accident with road closure	Tunkhannock Township
02/26/2016	Hit and run accident involving fire apparatus	East Stroudsburg Borough
02/27/2016	Vehicle accident with road closure	Chestnuthill Township
02/28/2016	Vehicle accident with entrapment	Paradise Township
02/28/2016	Vehicle vs. motorcycle accident	Chestnuthill Township
03/07/2016	Vehicle accident with entrapment	East Stroudsburg Borough
03/10/2016	Vehicle accident with road closure	Polk Township

Date	Event	Municipality
03/13/2016	Vehicle accident with entrapment	Tobyhanna Township
03/14/2016	School bus accident	Stroud Township
03/15/2016	Vehicle struck a utility pole with road closure	Middle Smithfield Township
03/17/2016	Triple fatal vehicle accident	Chestnuthill Township
03/18/2016	Vehicle accident involving a police vehicle	Coolbaugh Township
03/18/2016	Fatal vehicle accident with road closure	Price Township
03/28/2016	Vehicle accident with road closure	Paradise Township
03/29/2016	Vehicle accident with road closure	Tobyhanna Township
03/30/2016	School bus accident	Coolbaugh Township
03/31/2016	Vehicle accident	Pocono Township
04/05/2016	School bus accident	Monroe County
04/07/2016	School bus vs. car accident	Polk Township
04/08/2016	Vehicle rollover	Hamilton Township
04/08/2016	Vehicle accident	Coolbaugh Township
04/13/2016	School bus accident	Tunkhannock Township
04/14/2016	Fatal vehicle accident	Hamilton Township
04/14/2016	Vehicle accident involving police	Stroud Township
04/19/2016	Aircraft emergency landing	Monroe County
04/28/2016	Vehicle accident with a utility pole	Paradise Township
04/29/2016	Vehicle accident with road closure	Tobyhanna Township
04/29/2016	School bus accident	Tunkhannock Township
05/12/2016	Vehicle vs. PennDOT truck accident with injuries	Coolbaugh Township
05/19/2016	School bus accident	Tobyhanna Township
05/27/2016	School bus accident	East Stroudsburg Borough
05/29/2016	Tractor-trailer rollover	Tobyhanna Township
05/29/2016	Vehicle accident with road closure	Pocono Township
06/06/2016	Vehicle rollover	Monroe County
06/10/2016	Vehicle accident involving a police vehicle	Stroud Township
06/12/2016	Vehicle accident with road closure	Pocono Township
06/15/2016	Fatal vehicle accident with road closure	Chestnuthill Township
06/16/2016	Vehicle accident with road closure	Mt. Pocono Borough
06/19/2016	Vehicle accident with road closure	Hamilton Township
06/20/2016	Vehicle accident with a major road closure	Coolbaugh Township
06/22/2016	Vehicle vs. farm tractor with multiple injuries	Eldred Township
06/28/2016	Fatal vehicle accident	Pocono Township

Date	Event	Municipality
06/30/2016	Vehicle accident with road closure	Hamilton Township
07/15/2016	Pedestrian struck	Stroudsburg Borough
07/15/2016	Vehicle accident with road closure	Hamilton Township
07/22/2016	Bus accident	Monroe County
07/24/2016	Pedestrian struck	Tunkhannock Township
07/28/2016	Vehicle accident with road closure	Pocono Township
08/03/2016	Fatal vehicle accident with road closure	Coolbaugh Township
08/06/2016	Vehicle accident involving fire apparatus	Pocono Township
08/11/2016	Vehicle accident with road closure	Ross Township
08/11/2016	Vehicle accident with road closure	Tobyhanna Township
08/12/2016	Vehicle accident involving EMS	Chestnuthill Township
08/15/2016	Vehicle accident with ramp closure	Hamilton Township
08/17/2016	Vehicle accident with entrapment and road closure	Smithfield Township
08/24/2016	Bus accident	Chestnuthill Township
08/26/2016	Vehicle accident with road closure and multiple injuries	Middle Smithfield Township
08/28/2016	Vehicle accident with road closure and multiple injuries	Tobyhanna Township
08/30/2016	Vehicle accident with multiple injuries and entrapment	Smithfield Township
09/01/2016	Three tractor-trailers involved in accident	Tobyhanna Township
09/07/2016	School bus accident	Smithfield Township
09/08/2016	Vehicle accident with injuries and road closure	Stroud Township
09/13/2016	Vehicle accident, wires down, vehicle on fire	Pocono Township
09/14/2016	School bus accident	Coolbaugh Township
09/22/2016	Vehicle vs. police cruiser accident	East Stroudsburg Borough
09/24/2016	Fatal vehicle accident with road closure	Ross Township
09/26/2016	School bus accident	Hamilton Township
10/06/2016	Vehicle accident with a fuel spill	Chestnuthill Township
10/18/2016	Bus accident	Coolbaugh Township
10/19/2016	School bus accident	Pocono Township
10/19/2016	Fatal vehicle accident	Chestnuthill Township
10/22/2016	Fatal vehicle accident	Ross Township
10/25/2016	Vehicle accident with road closure	Pocono Township
10/27/2016	Vehicle accident with a gas leak	Stroudsburg Borough
10/29/2016	Vehicle accident with ejection and a road closure	Tobyhanna Township

Date	Event	Municipality
10/31/2016	Vehicle accident with road closure	Tobyhanna Township
11/01/2016	Tractor-trailer accident	Tobyhanna Township
11/01/2016	Vehicle accident	Stroud Township
11/03/2016	Fire apparatus accident	Monroe County
11/03/2016	Pedestrian struck	Hamilton Township
11/09/2016	Tractor-trailer accident	Monroe County
11/10/2016	School bus vs. ambulance	Chestnuthill Township
11/17/2016	Vehicle accident with road closure	Chestnuthill Township
11/18/2016	Vehicle accident with multiple injuries	Pocono Township
11/18/2016	Vehicle vs. PennDOT truck	Stroud Township
11/21/2016	School bus vs. vehicle accident	Tobyhanna Township
11/26/2016	Vehicle accident with ejection	Stroud Township
12/06/2016	Tractor-trailer vs. vehicle accident	Coolbaugh Township
12/07/2016	Tractor-trailer accident with road closure	Coolbaugh Township
12/09/2016	Vehicle accident with road closure	Hamilton Township
12/14/2016	Vehicle vs. sheriff vehicle accident	Smithfield Township
12/29/2016	Vehicle accident with road closure	Hamilton Township
12/31/2016	Fatal accident	East Stroudsburg Borough
01/02/2017	Ambulance involved in an accident	Hamilton Township
01/02/2017	Vehicle accident with road closure on I-80	Tunkhannock Township
01/03/2017	School bus accident	Price Township
01/11/2017	Ambulance involved in an accident	Coolbaugh Township
01/12/2017	School bus accident	Polk Township
01/16/2017	Vehicle struck bridge, causing structural damage	Pocono Township
01/24/2017	Vehicle accident with a closure on I-80	East Stroudsburg Borough
01/30/2017	School bus accident	Middle Smithfield Township
01/31/2017	Tractor-trailer accident with road closure	Smithfield Township
02/01/2017	EMS unit involved in an accident	Pocono Township
02/02/2017	Fatal vehicle accident	Coolbaugh Township
02/10/2017	Vehicle accident with multiple injuries	Pocono Township
02/14/2017	Vehicle accident with entrapment	Stroud Township
02/14/2017	Vehicle accident with road closure on Route 447	Stroud Township
02/23/2017	School bus accident	Middle Smithfield Township
02/28/2017	School bus accident	Stroudsburg Borough

Date	Event	Municipality
02/28/2017	Car vs. school bus accident	Ross Township
03/07/2017	School bus accident	Coolbaugh Township
03/10/2017	Vehicle accident with road closure	Jackson Township
03/15/2017	Vehicle accident involving a police vehicle	Coolbaugh Township
03/16/2017	Bus accident	Paradise Township
03/24/2017	Vehicle accident	Smithfield Township
04/05/2017	Vehicle accident involving a school bus	Stroudsburg Borough
04/13/2017	School bus accident	Stroudsburg Borough
04/27/2017	Vehicle accident with injuries and a closure on I-80	Pocono Township
04/28/2017	School bus accident	Chestnuthill Township
04/29/2017	Vehicle accident involving an EMS unit	Stroudsburg Borough
05/01/2017	School bus accident	Coolbaugh Township
05/12/2017	School bus accident	Chestnuthill Township
05/15/2017	Vehicle accident with road closure	Coolbaugh Township
06/17/2017	School bus vs. pole accident	Coolbaugh Township
06/09/2017	Vehicle accident involving an EMS unit	Chestnuthill Township
06/09/2017	Vehicle accident	Stroud Township
06/10/2017	Vehicle accident involving a police unit	Tobyhanna Township
06/12/2017	Fatal vehicle accident with interstate lane closure	Coolbaugh Township
06/13/2017	Vehicle accident	Hamilton Township
06/18/2017	Vehicle accident involving a police vehicle	East Stroudsburg Borough
06/19/2017	Car vs. a bus accident	Smithfield Township
06/19/2017	Tractor-trailer accident with road closure	Hamilton Township
06/24/2017	Vehicle accident with road closure on I-80	Stroudsburg Borough
07/07/2017	Vehicle accident	Hamilton Township
07/13/2017	Vehicle accident with road closure	Tobyhanna Township
07/20/2017	Tractor-trailer rollover	Hamilton Township
07/24/2017	Vehicle accident involving a police vehicle	Pocono Township
08/01/2017	Vehicle accident involving fire apparatus	Pocono Township
08/01/2017	Vehicle accident with entrapment	Hamilton Township
08/03/2017	Vehicle accident with road closure	Stroud Township
08/18/2017	Vehicle accident with road closure	Polk Township
09/03/2017	Vehicle accident with multiple injuries	Coolbaugh Township
09/04/2017	Vehicle accident with multiple injuries	Tobyhanna Township
09/13/2017	Vehicle accident involving an EMS unit	Hamilton Township
09/14/2017	School bus accident	Chestnuthill Township

Date	Event	Municipality
09/15/2017	Vehicle accident involving a police unit	Stroudsburg Borough
09/19/2017	Vehicle accident with injuries following a police pursuit	Coolbaugh Township
09/19/2017	School bus accident	Smithfield Township
09/22/2017	School bus accident	Stroud Township
10/09/2017	Vehicle accident with road closure	Hamilton Township
10/10/2017	Car vs. school bus accident	Stroud Township
10/12/2017	Vehicle accident with road closure	Coolbaugh Township
10/18/2017	Vehicle accident with injuries and involving an EMS unit	Smithfield Township
10/18/2017	Vehicle accident with road closure	Stroud Township
10/18/2017	Fatal vehicle accident with road closure	Coolbaugh Township
10/19/2017	School bus accident	Coolbaugh Township
10/24/2017	School bus accident involving wires	Coolbaugh Township
10/26/2017	Vehicle accident with road closure	Delaware Water Gap Borough
10/28/2017	Vehicle accident with road closure	Smithfield Township
10/28/2017	Vehicle accident with road closure	Stroud Township
10/30/2017	Vehicle accident with road closure	Coolbaugh Township
11/05/2017	Vehicle accident with multiple injuries	Tunkhannock Township
12/04/2017	Vehicle accident involving a police vehicle	Mt. Pocono Borough
12/06/2017	Fatal pedestrian accident with a road closure	Tobyhanna Township
12/09/2017	Vehicle accident with road closure	Stroud Township
12/15/2017	School bus accident	Monroe County
12/21/2017	Vehicle accident with road closure	Middle Smithfield Township
01/01/2018	Car vs. a PSP vehicle	Pocono Township
01/03/2018	Car vs. a school bus	Pocono Township
01/13/2018	Vehicle accident with road closure	Coolbaugh Township
01/19/2018	School bus accident	Chestnuthill Township
01/23/2018	Vehicle accident involving a police vehicle	Paradise Township
01/28/2018	Vehicle accident involving a police vehicle	Pocono Township
02/10/2018	Vehicle accident with road closure	Chestnuthill Township
02/11/2018	Vehicle accident with entrapment	Pocono Township
02/13/2018	Car vs. school bus	Stroud Township
02/19/2018	Vehicle accident with road closure	Coolbaugh Township

Date	Event	Municipality
02/19/2018	School bus accident	Coolbaugh Township
02/19/2018	School bus vs. vehicle	Coolbaugh Township
02/19/2018	Fatal vehicle accident with a road closure	Chestnuthill Township
02/21/2018	Vehicle accident involving fire apparatus	Stroudsburg Borough
02/28/2018	Fatal vehicle accident	Paradise Township
02/28/2018	Vehicle accident with road closure, car vs. pole	Tunkhannock Township
03/02/2018	Vehicle accident with road closure	Coolbaugh Township
03/02/2018	Vehicle accident involving an ambulance	Pocono Township
03/12/2018	Vehicle accident involving a police vehicle	Coolbaugh Township
03/14/2018	School bus accident	Coolbaugh Township
03/22/2018	Vehicle accident with road closure	Pocono Township
04/03/2018	Fatal vehicle accident	Jackson Township
04/06/2018	Vehicle accident with road closure	Chestnuthill Township
04/10/2018	Vehicle accident involving DOT workers	Tobyhanna Township
04/19/2018	Vehicle accident with road closure on Route 611	Coolbaugh Township
04/21/2018	Fatal pedestrian accident	Chestnuthill Township
04/22/2018	Motorcycle accident with a road closure	Middle Smithfield Township
04/26/2018	Fatal pedestrian accident	Hamilton Township
04/26/2018	Vehicle accident	Stroud Township
05/02/2018	Vehicle accident with multiple injuries	Pocono Township
05/14/2018	School bus accident	Pocono Township
05/14/2018	Bus accident	Stroud Township
06/14/2018	Fatal vehicle accident	Chestnuthill Township
06/16/2018	Car vs. motorcycle accident	Chestnuthill Township
06/24/2018	Vehicle accident involving an EMS unit	Tobyhanna Township
06/27/2018	Vehicle accident with road closure	Chestnuthill Township
07/27/2018	Bus vs. pedestrians	East Stroudsburg Borough
07/30/2018	Vehicle accident with entrapment	Stroud Township
08/02/2018	Vehicle accident with entrapment involving live wires	Polk Township
08/02/2018	Vehicle accident with road closure	Coolbaugh Township
08/12/2018	Vehicle accident involving a police vehicle	Stroudsburg Borough
08/26/2018	Car vs. pedestrian	Hamilton Township
08/28/2018	School bus accident	Pocono Township
09/14/2018	School bus accident with no injuries	Pocono Township

Date	Event	Municipality
09/16/2018	Vehicle accident with road closure	Hamilton Township
09/16/2018	Vehicle accident with road closure	Stroud Township
09/21/2018	Fatal pedestrian accident	Mt. Pocono Borough
09/21/2018	Vehicle accident involving an EMS unit	Coolbaugh Township
10/02/2018	School bus accident	Tunkhannock Township
10/05/2018	School bus accident	Mt. Pocono Borough
10/06/2018	Vehicle accident with entrapment and fatality	Pocono Township
10/10/2018	Small plane down in a lake	Monroe County
10/14/2018	Bus crash on Route 380	Stroud Township
10/15/2018	School bus accident	Stroudsburg Borough
10/16/2018	Bus accident	Pocono Township
11/06/2018	School bus vs. car accident with injuries	Polk Township
11/12/2018	Vehicle accident with road closure	Coolbaugh Township
11/16/2018	Vehicle accident involving a township dump truck	Eldred Township
12/01/2018	Vehicle accident involving a police cruiser	East Stroudsburg Borough
12/10/2018	Bus accident	Coolbaugh Township
12/16/2018	Vehicle accident involving an ambulance	Stroud Township
12/26/2018	Vehicle accident with road closure	Chestnuthill Township
01/08/2019	Vehicle accident with road closure	Chestnuthill Township
01/09/2019	Vehicle accident with road closure	Chestnuthill Township
01/25/2019	Fatal vehicle accident	Middle Smithfield Township
01/25/2019	Fatal vehicle accident with road closure	Jackson Township
01/29/2019	Vehicle accident with road closure	Chestnuthill Township
02/09/2019	Vehicle accident involving a police vehicle	Coolbaugh Township
02/14/2019	Vehicle accident involving a police cruiser	Tobyhanna Township
02/17/2019	EMS unit vs. car accident	East Stroudsburg Borough
02/22/2019	Vehicle accident with road closure	Chestnuthill Township
02/28/2019	Car vs. bus accident	Hamilton Township
03/06/2019	Car vs. school bus accident	Tobyhanna Township
03/06/2019	School bus accident	Smithfield Township
03/09/2019	Car vs. school van	Tobyhanna Township
03/09/2019	Vehicle accident with entrapment and multiple injuries	Stroud Township
03/09/2019	Vehicle accident with wires down	Stroud Township
03/10/2019	Vehicle accident involving a tractor-trailer	Tobyhanna Township

Date	Event	Municipality
03/17/2019	Vehicle accident with road closure	Smithfield Township
03/23/2019	Vehicle accident with road closure	Pocono Township
03/24/2019	Vehicle accident with road closure	Hamilton Township
03/27/2019	Vehicle accident involving an EMS unit	Stroudsburg Borough
03/29/2019	Vehicle accident	Pocono Township
04/06/2019	Vehicle accident with entrapment	Chestnuthill Township
04/11/2019	School bus accident	Stroud Township
04/11/2019	School bus accident	Paradise Township
04/17/2019	Vehicle accident involving a police cruiser	East Stroudsburg Borough
04/17/2019	Vehicle accident with road closure	Hamilton Township
04/24/2019	Fatal vehicle accident with road closure	Pocono Township
04/25/2019	Vehicle accident with road closure	Hamilton Township
05/01/2019	Car vs. county transit bus	Tobyhanna Township
05/18/2019	Motorcycles vs. truck accident	Eldred Township
05/18/2019	Two vehicle accident	Middle Smithfield Township
05/22/2019	Vehicle accident with road closure	Stroud Township
05/22/2019	Car vs. mini-school bus	Chestnuthill Township
05/22/2019	Pedestrian accident	East Stroudsburg Borough
05/29/2019	School bus accident	Stroud Township
05/31/2019	Fatal vehicle accident, car vs. motorcycle	Eldred Township
06/13/2019	Tractor-trailer rollover on I-80	Tunkhannock Township
06/26/2019	Transit bus accident	Pocono Township
07/11/2019	Vehicle accident with fire	Chestnuthill Township
07/12/2019	Vehicle accident with road closure	Polk Township
07/12/2019	Car into a house	Stroudsburg Borough
07/24/2019	Commercial truck into a house	Eldred Township
07/31/2019	Tractor-trailer vs. tractor-trailer accident with entrapment	Jackson Township
08/01/2019	Tractor-trailer vs. PennDOT Crash Truck	Coolbaugh Township
08/12/2019	Vehicle accident involving a county sheriff's unit	Stroud Township
09/06/2019	Vehicle accident involving a police vehicle	Smithfield Township
09/07/2019	Vehicle accident with road closure	Pocono Township
09/11/2019	Vehicle accident involving a police officer	Tobyhanna Township
09/19/2019	School bus accident	Middle Smithfield Township

Date	Event	Municipality
09/25/2019	Ambulance vs. deer accident	Pocono Township
10/02/2019	Fatal vehicle accident with road closure	Tobyhanna Township
10/15/2019	Vehicle accident involving police	Pocono Township
11/05/2019	Vehicle accident with entrapment	Pocono Township
11/05/2019	School bus accident	Chestnuthill Township
11/07/2019	Vehicle accident with road closure	Polk Township
11/19/2019	Vehicle accident with injury involving law enforcement	Pocono Township
11/20/2019	Vehicle accident with road closure	Stroudsburg Borough
11/25/2019	School bus accident	Middle Smithfield Township
11/26/2019	Vehicle accident involving a police cruiser	Pocono Township
12/09/2019	Fatal vehicle accident	Pocono Township
12/10/2019	School bus accident	Tunkhannock Township
12/17/2019	Vehicle accident involving an EMS unit	Mt. Pocono Borough
12/19/2019	Vehicle accident with road closure	Tobyhanna Township
12/21/2019	Vehicle accident with road closure	Tunkhannock Township
01/16/2020	Vehicle accident with road closure	Tunkhannock Township
01/21/2020	Vehicle accident with road closure	Pocono Township
01/27/2020	Fatal vehicle accident	Hamilton Township
01/31/2020	Vehicle accident with road closure	Chestnuthill Township
02/02/2020	Vehicle accident with road closure	Mt. Pocono Borough
02/07/2020	Vehicle accident with entrapment	Tunkhannock Township
02/20/2020	Car vs. school bus	Pocono Township
02/21/2020	Vehicle accident	Coolbaugh Township
02/28/2020	Vehicle accident with road closure	Chestnuthill Township
02/28/2020	School bus accident	Ross Township
03/30/2020	Vehicle accident involving police	Coolbaugh Township
04/26/2020	Vehicle accident with road closure	Pocono Township
05/16/2020	ATV accident	Coolbaugh Township
05/18/2020	Fatal accident, car vs. tree	Ross Township
05/21/2020	Vehicle accident with road closure, car vs. pole	Mt. Pocono Borough
05/23/2020	Vehicle accident with road closure	Pocono Township
06/30/2020	Car vs. motorcycle with fire accident	Middle Smithfield Township
07/02/2020	Vehicle accident involving an EMS unit	Mt. Pocono Borough

Date	Event	Municipality
09/19/2019	School bus accident	Middle Smithfield Township
07/08/2020	Vehicle accident with injury involving PSP	Pocono Township
07/13/2020	Vehicle accident with road closure	Pocono Township
07/23/2020	Vehicle accident involving police	Paradise Township
07/31/2020	Vehicle accident with a fuel spill, closing roadway	Chestnuthill Township
08/14/2020	Vehicle fire closing the interstate	Stroud Township
08/18/2020	Vehicle accident with road closure	Middle Smithfield Township
09/15/2020	Bus accident	Monroe County
09/22/2020	Vehicle accident involving police personnel	Monroe County
10/06/2020	Tour bus involved in an accident	East Stroudsburg Borough
10/14/2020	School bus accident	Chestnuthill Township
10/16/2020	School bus accident	Stroud Township
10/20/2020	Fatal vehicle accident	Polk Township
10/26/2020	School bus accident	Smithfield Township
10/30/2020	Vehicle accident with road closure of I-380	Monroe County
11/07/2020	Vehicle accident with road closure	Tunkhannock Township
11/10/2020	Vehicle accident with road closure	Chestnuthill Township
11/17/2020	Vehicle accident involving a police vehicle	Coolbaugh Township
11/20/2020	Vehicle accident with road closure	Hamilton Township
11/21/2020	Vehicle accident with road closure	Coolbaugh Township
11/24/2020	Vehicle accident with road closure	Stroudsburg Borough
11/25/2020	Vehicle accident with injury	Jackson Township
11/29/2020	Vehicle accident with road closure of I-380	Coolbaugh Township
11/30/2020	Fatal vehicle accident	Mt. Pocono Borough
11/30/2020	Vehicle accident with road closure	Monroe County
12/02/2020	Car vs. school bus accident	Coolbaugh Township
12/06/2020	Vehicle accident with road closure	Monroe County
12/07/2020	Vehicle accident	Jackson Township
12/09/2020	Vehicle accident involving a police vehicle	Pocono Township
12/25/2020	Vehicle accident with road closure and a natural gas leak	Pocono Township
01/03/2021	Vehicle accident with road closure	Stroudsburg Borough
01/03/2021	Vehicle accident with a fuel leak	Stroudsburg Borough
01/21/2021	Vehicle accident involving an EMS unit	Chestnuthill Township

Between June 25, 2009 and January 26, 2021 there were a total of 171 bus accidents. These accidents pose a greater risk for mass casualty incidents. On January 28, 2010 alone, there were a total of four bus accidents. The Monroe County bus accident statistics for each year are shown in *Table 67 – Monroe County Bus Accidents.*

Table 67 - Monroe County Bus Accidents

Monroe County Bus Accidents from 2009 to 2020					
Year	**Total bus accidents**	**Year**	**Total bus accidents**	**Year**	**Total bus accidents**
2009	4	2013	11	2017	22
2010	25	2014	10	2018	17
2011	21	2015	9	2019	13
2012	12	2016	19	2020	8

Eight aircraft accidents and/or incidents have occurred between 2009 and 2020. These were:

- August 30, 2009 – Aircraft accident that resulted in the death of the pilot.
- August 31, 2012 – Aircraft accident with one occupant and no injuries and occurred in Seven Pines Park.
- October 17, 2012 – Unknown situation.
- September 29, 2013 – Unknown situation.
- August 21, 2014 – Aircraft accident with one occupant with minor injuries and happened near the cemetery at Kreger Road and Gretchen Road, Polk Township.
- April 19, 2016 – An aircraft had to make an emergency landing.
- October 10, 2018 – A small plane down in a lake.
- September 17, 2019 – A small plane was missing, following a search the plane was found the next day crashed into a swamp area. There were two fatalities reported.

The Pennsylvania Department of Transportation publishes a booklet reporting crash facts and statistics on an annual basis. *Table 68 – Monroe County Crash Facts and Statistics* outlines the transportation crash data to include the total number of crashes in both Monroe County and Pennsylvania, the number of fatal crashes in the county, and the total number of fatalities each year for both the county and the Commonwealth.

Table 68 - Monroe County Crash Facts and Statistics

Monroe County Crash Facts and Statistics 2009 to 2019								
Year	Total crashes			Total number of fatal crashes in Monroe County	Total fatalities		Pedestrian deaths	
	Monroe County	Percentage of seat belt usage in crashes for Monroe County	Pennsylvania		Monroe County	Pennsylvania	Monroe County	Pennsylvania
2009	2,113	89%	121,242	28	30	1,256	4	136
2010	2,439	88%	121,312	33	35	1,324	5	148
2011	2,375	88%	125,395	32	33	1,286	4	149
2012	2,256	86%	124,092	26	27	1,310	1	168
2013	2,269	87%	124,149	24	25	1,208	0	151
2014	2,163	87%	121,317	18	23	1,195	1	166
2015	2,504	91%	127,127	32	34	1,200	4	153
2016	2,621	91%	129,395	21	29	1,188	1	172
2017	2,456	91%	128,188	17	18	1,137	4	150
2018	2,461	90%	128,420	18	21	1,190	3	201
2019	2,393	91%	125,267	16	17	1,059	1	154

There were no reported train versus vehicle crashes in Monroe County between 2009 and 2019 according to the Pennsylvania Department of Transportation published booklet on crash facts and statistics.

4.3.19.4 Future Occurrence

The probability of a transportation accident is highly likely. Automobile accidents, ranging from minor to fatal, will occur more frequently than a railway or aviation accident.

Transportation hazards are impossible to predict accurately; however, areas prone to these hazards can be located, quantified through analysis of historical records, and plotted on countywide and municipality base maps. Certain characteristics that contribute to the occurrence or increased vulnerability to these hazards can be identified, particularly, in areas that may be prone.

Assuming that transportation accidents are as likely to occur in the future as they have occurred in the past, and based on the available data, Monroe County can expect the following each year:

- Approximately 2,394 vehicle accidents (this number may be much higher or lower; however, this figure is based on a ten-year average of vehicle accidents captured from PennDOT).
- Zero to one railway incidents, most likely involving a pedestrian or vehicle being struck by a train.
- Zero to one aviation accidents.

4.3.19.5 Vulnerability Assessment

The vulnerability for accidents; highway, railway, or aviation, are directly related to the population and traffic density within the county. The vulnerability increases if there are hazardous materials involved. Hazards associated with causing transportation accidents can be natural hazards that affect the environment such as winter storms or heavy rains causing slippery roadways or mud slides; to windstorms or tornadoes that cause high-profile vehicles or train cars to be toppled over.

Loss of roadway use, and public transportation services would affect thousands of commuters, employment, delivery of critical municipal and emergency services, and day-to-day operations within the county. Disruption of one or more modes of transportation in use in Monroe County can lead to congestion and affect both the county and the region.

Studying traffic and potential transportation accident patterns could provide information on vulnerability of specific road segments and nearby populations. Increased understanding of the types of hazardous materials transported through the county will also support mitigation efforts. Maintaining a record of these frequently transported materials can facilitate development of preparatory measures for response to a release.

Figure 60 - Major Highways and Railroads

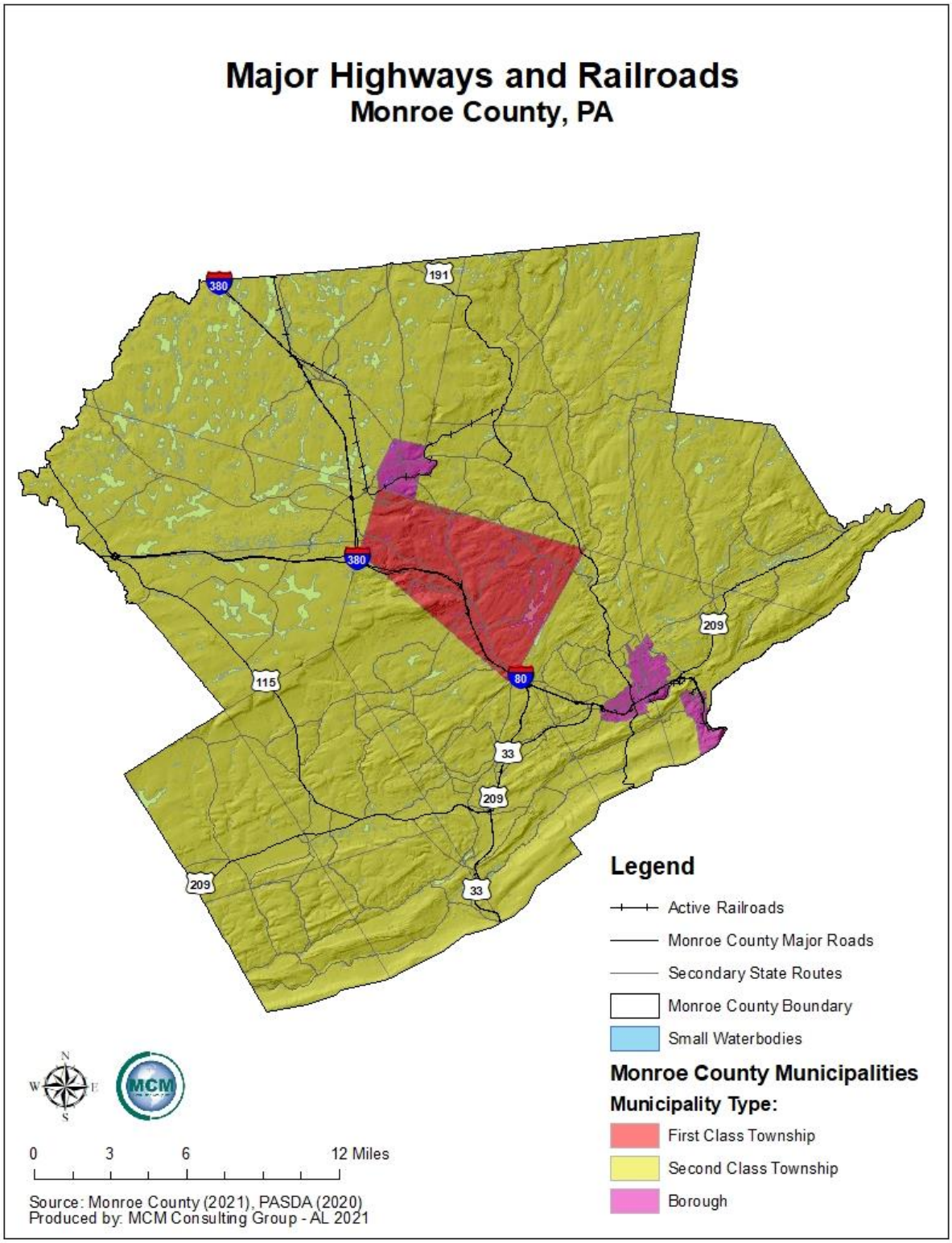


Figure 61 - Airport Vulnerability Map

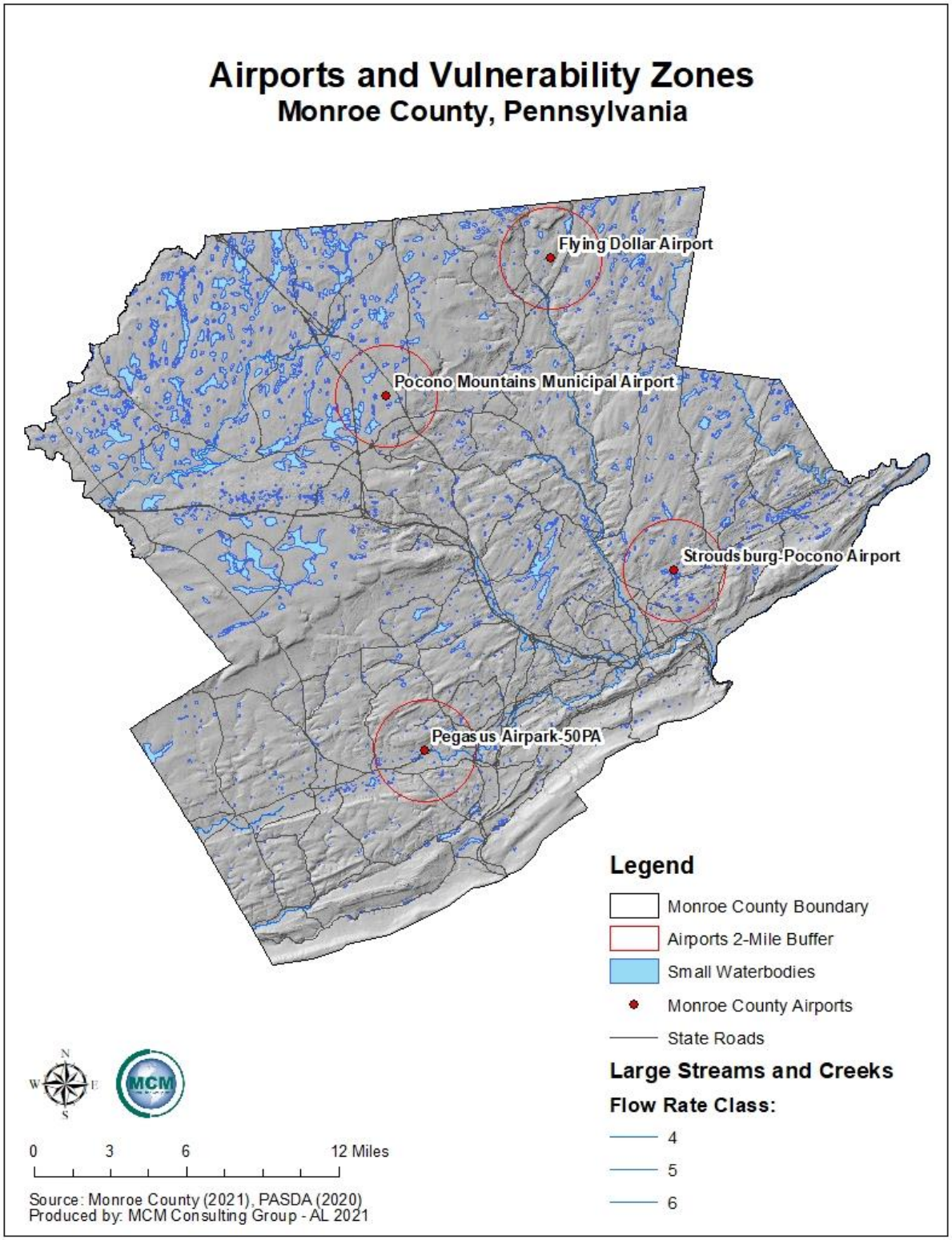
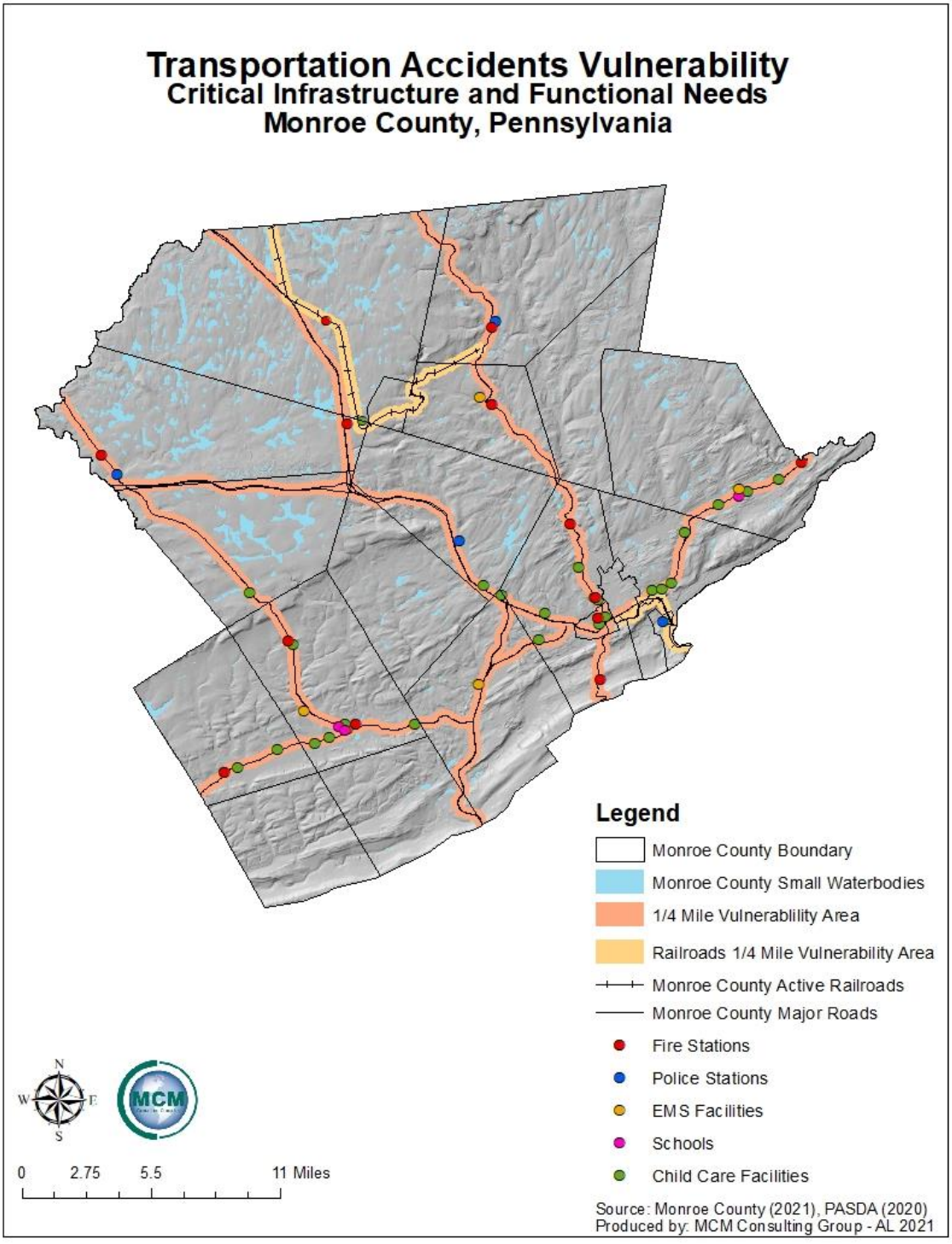


Figure 62 – Transportation Accidents Vulnerability Map identifies the critical infrastructure and functional needs facilities along major roadways and railways in Monroe County.

Figure 62 - Transportation Accidents Vulnerability Map



4.3.20. Utility Interruptions

4.3.20.1 Location and Extent

Utility interruptions can occur from an internal system failure, or as a secondary impact of another hazard, such as a windstorm or a traffic accident. Examples of other hazards could be severe thunderstorms or winter storms that bring down power lines and cause widespread disruptions in electric service. Strong heat waves may result in rolling blackouts where power may not be available for an extended period of time.

The age of utility infrastructure can also play an important role in interruptions, causing longer periods of outages in a larger area. Natural gas, water, telecommunications, and electric capabilities can all experience disruptions. Worker strikes at power generation facilities have also been known to cause minor power failures. Some other causes of minor power outages include falling tree limbs, vehicle accidents, or small animals that destroy wiring. Outages can also be caused by blown transformers or tripped circuit breakers. Major power outages are typically on a regional scale.

Utility providers in Monroe County are shown in *Table 69 – Monroe County Utility Providers*.

Table 69 - Monroe County Utility Providers

Monroe County Utility Providers	
Utility Provided	**Name of Utility Provider**
Electricity	Pennsylvania Power and Light (PP&L)
Electricity and natural gas	Public Service Electirc & Gas (PSE&G)
Natural gas	TC Energy UGI Utilities, Inc. Williams Gas Pipeline
Water	Brodhead Creek Regional Authority East Stroudsburg Water

4.3.20.2 Range of Magnitude

Utility interruptions do not typically lead to large-scale problems by themselves. Typically, human casualties are not a direct result from outages. Because many utility interruptions occur during storms or other severe weather events, they can have severe secondary consequences. Typical secondary effects from a power outage could be a delay in emergency response services from poor communication or a lack of potable water for drinking.

Electricity

Interruptions or power failures could impact the following:

- Food spoilage
- Heating or air conditioning
- Basement flooding – due to sump pump failure
- Indoor lighting
- Internet service
- Traffic signals
- Elevator
- Retail sale

Of all these, the loss of heating or air conditioning poses the greatest risk to the elderly and very young populations during times of extreme temperatures. Prolonged power outages also pose a risk to residents that rely on home-based medical equipment such as home-supply oxygen units.

Fuel

From natural gas to other products transported and delivered by way of pipelines to business and residences, interruptions pose loss of heating and manufacturing capabilities.

Telecommunications

Interruptions to telecommunications systems include impacts to 9-1-1 capabilities, telephone, and internet service. The greatest risk to the loss of this capability would be in reporting an emergency to a public safety answering point (PSAP). Extensive loss of telephone and internet service can be detrimental to government, business, and to residents.

4.3.20.3 Past Occurrence

Minor utility interruptions occur annually in Monroe County, most often in conjunction with winter and windstorms. Monroe County utilizes a database system called Corvena (formerly Knowledge Center™) to track incidents. *Table 70 – Utility Interruptions in Monroe County* shows interruptions to electric, natural gas, telecommunications, and water service from Corvena entries.

Table 70 - Utility Interruptions in Monroe County

Utility Interruptions in Monroe County		
Date	**Event**	**Municipality**
07/15/2009	Water main break	East Stroudsburg Borough
09/22/2009	Power outage	Pocono Township
05/08/2010	Utility emergency	Chestnuthill township
04/16/2011	Transportation emergency, utility involved	Stroud Township
05/26/2011	Power outage	Monroe County

Date	Event	Municipality
08/23/2011	Gas line beak	Stroudsburg Borough
08/31/2011	Utility threats	Pocono Township
02/23/2012	Planned power outage	Hamilton Township
04/24/2012	Boil water advisory	Delaware Water Gap Borough
06/09/2012	Water main break	Coolbaugh Township
09/04/2012	Power outages and flooding	Monroe County
11/06/2012	Power outage	Pocono Township
05/01/2013	Water main break	East Stroudsburg Borough
07/27/2013	Natural gas line work	Ross Township
01/05/2014	Power outage	Barrett Township
01/08/2014	Power outage	Pocono Medical Center
01/08/2014	Power outage	Monroe County
05/20/2014	Water main break	Stroud Township
08/15/2014	Gas line leak	East Stroudsburg Borough
11/23/2014	Power outage following a planned power outage	East Stroudsburg Borough
12/25/2014	Power outage	Monroe County
01/18/2015	Transportation emergency – car vs. utility pole	Coolbaugh Township
04/20/2015	Multiple power outages	Monroe County
05/16/2015	Partial power outage –ESASD North	Monroe County
06/30/2015	Transportation emergency with power outage	Pocono Township
07/01/2015	Telephone outage	Tobyhanna Township
09/18/2015	Power outage	Monroe County
09/25/2015	911 phone outage	Monroe County
11/19/2015	Power outage	Barrett Township
12/04/2015	Power outage	East Stroudsburg Borough
12/29/2015	Severe weather-related power outages until 01/06/2016	Monroe County
01/19/2016	Power outage	Chestnuthill Township
01/28/2016	Network outage	Monroe County offices
04/14/2016	Verizon pole damage due to a motor vehicle accident	Middle Smithfield Township
07/10/2016	Water utility maintenance until 08/05/2016	Monroe County
07/26/2016	Phone outage	Stroudsburg Borough
08/03/2016	Telephone issue	Tobyhanna Township
08/16/2016	Power lines down with a road closure	Hamilton Township

Date	Event	Municipality
03/02/2017	Power outage	Hamilton Township
03/02/2017	Power outage	Stroud Township
10/08/2017	Telephone outage	Tobyhanna Township
01/13/2018	Tree on wires with a road closure	Pocono Township
01/13/2018	Phone outage	Tunkhannock Township
01/18/2018	Phone outage	Tobyhanna Township
01/18/2018	Water main break	Mt. Pocono Borough
06/08/2018	Cross contamination	Tobyhanna Township
09/11/2018	Wires down with a road closure	Price Township
12/19/2018	Phone outage	Tobyhanna Township
03/12/2019	Water outage	East Stroudsburg Borough
05/29/2019	Phone outage	Tunkhannock Township
07/28/2019	Verizon portal issue	Monroe County
07/31/2019	Phone outage	Tunkhannock Township
08/25/2019	Phone outage	Hamilton Township
11/15/2020	911 land line outage	Tunkhannock Township

Terrorism is another threat to utility providers. In 2011, a citizen made threats over the telephone to Pennsylvania Power & Light. The citizen was upset over the lack of power to his residence in Pocono Township.

The Pennsylvania Public Utility Commission tracks the reliability of electric distribution companies (EDC) and outages. *Table 71 –2018 Winter Storms Riley and Quinn Power Outages by EDC* compares the customers affected by power outage in Pennsylvania during these storms and compares them to statistics from Nika 2014 and Sandy 2012. Some of the EDCs were not impacted by Winter Storm Quinn. PPL customers experienced power outages for a duration of eight days with Winter Storms Quinn and Riley, whereas during Sandy in 2012 the duration was nine days, and just over three days for Nika in 2014.

Table 71 - 2018 Winter Storms Riley and Quinn Power Outages by EDC

2018 Winter Storms Riley and Quinn Power Outages			
EDC	**Customers affected by storms Riley and Quinn 2018 (Percentage of total customers)**	**Customers affected by Nika 2014 (Percentage of total customers)**	**Customers affected by Sandy 2012 (Percentage of total customers)**
Met-Ed	272,928 (49.22%)	144,000 (26.00%)	298,300 (54.00%)
PECO	794,969 (46.76%)	723,681 (42.00%)	845,703 (54.20%)
Penelec	90,856 (15.61%)	N/A	96,847 (16.40%)

EDC	Customers affected by storms Riley and Quinn 2018 (Percentage of total customers)	Customers affected by Nika 2014 (Percentage of total customers)	Customers affected by Sandy 2012 (Percentage of total customers)
PCLP	2,101 (47.44%)	N/A	4,487 (100.00%)
PPL	261,341 (18.67%)	92,283 (7.00%)	523,936 (37.50%)
Total	1,422,195	959,964	1,769,273

Source Winter Storm Riley and Quinn Report 2019

4.3.20.4 Future Occurrence

Utility interruptions are difficult to predict, even though minor interruptions may occur several times a year to all utilities. Even so, utility interruptions occur more frequently as a secondary factor to severe weather events or transportation accidents.

As utility infrastructure ages, interruption events could occur more frequently. Utility providers can reduce Monroe County's vulnerability to power outages by implementing an improvement plan.

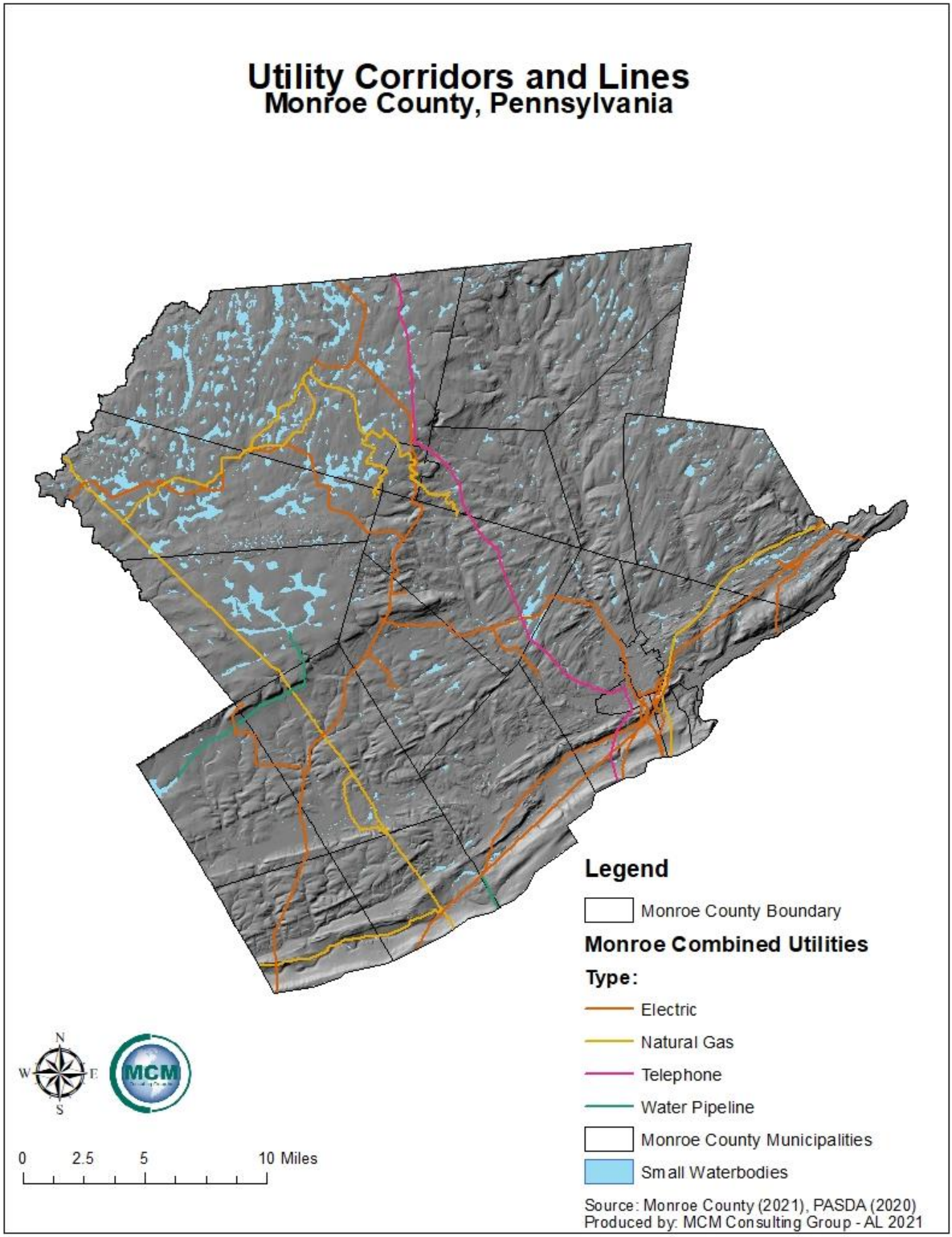
4.3.20.5 Vulnerability Assessment

Resources such as electricity, communications, gas, and water supply are critical to ensure the health, safety, and general welfare of the citizenry. Power outages can cause even greater detriment to at-risk and vulnerable populations, such as the elderly or those with functional and access needs. All critical infrastructures are vulnerable to the effects of a power outage. The probability of a large-scale, extended utility failure is low; however, small-scale failures lasting short periods of time occur annually.

Long-term care facilities, senior centers, hospitals, and emergency medical facilities are all vulnerable to utility interruptions. Often back-up power generators are used at these facilities to off-set electrical needs during extremes of hot or cold temperatures. However, these back-up power generators must be maintained, and fuel supplies must be secured in advance of the utility interruption to ensure a seamless transition from the everyday power source to the emergency generator. Long-term use of back-up generators should be planned for when considering maintenance and supplies for a facility.

Figure 63 - Monroe County Utility Lines shows the locations of utilities throughout the county.

Figure 63 - Monroe County Utility Corridors and Lines



4.4. Hazard Vulnerability Summary

4.4.1. Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A risk factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also assist local community officials in ranking and prioritizing hazards that pose the most significant threat to a planning area based on a variety of factors deemed important by the planning team and other stakeholders involved in the hazard mitigation planning process. The RF system relies mainly on historical data, local knowledge, general consensus from the planning team and information collected through development of the hazard profiles included in Section 4.3. The RF approach produces numerical values that allow identified hazards to be ranked against one another; the higher the RF value, the greater the hazard risk.

RF values were obtained by assigning varying degrees of risk to five categories for each of the hazards profiled in the HMP update. Those categories include *probability*, *impact*, *spatial extent*, *warning time and duration*. Each degree of risk was assigned a value ranging from one to four. Monroe County LPT decided the best approach was to have all municipalities complete a Risk Factor Assessment. *Tables 73 – 91* below depict the results of all municipalities in Monroe County on the Risk Factor Assessment. The average RF score submitted by each municipality was agreed upon by the planning team and is shown in *Table 72 – Risk Factor Assessment*. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the following example equation:

Risk Factor Value =
[(Probability x .30) + (Impact x .30) +(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

Table 72 – Risk Factor Approach Summary summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 72 - Risk Factor Approach Summary

Summary of Risk Factor Approach Used to Rank Hazard Risk.					
RISK ASSESSMENT CATEGORY	**DEGREE OF RISK**				**WEIGHT VALUE**
	LEVEL	**CRITERIA**		**INDEX**	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**UNLIKELY**	LESS THAN 1% ANNUAL PROBABILITY		1	30%
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY		2	
	LIKELY	BETWEEN 10 &100% ANNUAL PROBABILITY		3	
	HIGHLY LIKELY	100% ANNUAL PROBABILTY		4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	**MINOR**	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.		1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.		2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.		3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.		4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	**NEGLIGIBLE**	LESS THAN 1% OF AREA AFFECTED		1	20%
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED		2	
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED		3	
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED		4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	**MORE THAN 24 HRS**	SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	12 TO 24 HRS	SELF-DEFINED		2	
	6 TO 12 HRS	SELF-DEFINED		3	
	LESS THAN 6 HRS	SELF-DEFINED		4	
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS**	SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	LESS THAN 24 HRS	SELF-DEFINED		2	
	LESS THAN 1 WEEK	SELF-DEFINED		3	
	MORE THAN 1 WEEK	SELF-DEFINED		4	

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, *Table 73 – Risk Factor Assessment* lists the risk factor calculated for each of twenty-two potential hazards identified in the 2021 HMP. Hazards identified as *high* risk have risk factors greater than 2.5. Risk factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with risk factors 1.9 and less are considered *low* risk.

Table 73 - Risk Factor Assessment

Risk Factor Assessment		
HAZARD RISK	**HAZARD NATURAL(N) OR HUMAN-CAUSED (H)**	**RISK FACTOR (RF)**
HIGH	Flash Flooding (N)	**3.3**
	Emergency Services Shortage (H)	**3.2**
	Utility Interruptions (H)	**3.1**
	Winter Storms (N)	**2.9**
	Pandemic & Infectious Disease (N)	**2.9**
	Transportation Accidents (H)	**2.8**
	Hazardous Materials - Transportation (H)	**2.65**
	Invasive Species (N)	**2.6**
	Wildfire (N)	**2.6**
	Opioid/Substance Abuse (H)	**2.5**
MODERATE	Drought (N)	**2.4**
	Hurricane/Tropical Storm (N)	**2.4**
	Windstorms (N)	**2.3**
	Flooding (N)	**2.3**
	Terrorism – Domestic (H)	**2.3**
	Cyber Terrorism/Incidents (H)	**2.3**
	Dam Failure (H)	**2.2**

HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK FACTOR (RF)
	Extreme Temperatures (H)	2.2
	Epidemic (H)	2.1
	Nuclear Incidents (H)	2.0
LOW	Hazardous Materials – Fixed Facilities (H)	1.9
	Drowning (H)	1.9
	Tornadoes (N)	1.9
	Disorientation (H)	1.8
	Levee Failure (H)	1.6

Based on these results, there are ten high risk hazards, ten moderate risk hazards, and five low risk hazards in Monroe County. Mitigation actions were developed for all high, moderate, and low risk hazards (see section 6.4). The threat posed to life and property for moderate and high-risk hazards is considered significant enough to warrant the need for establishing hazard-specific mitigation actions. Mitigation actions related to future public outreach and emergency service activities are identified to address low risk hazard events.

Table 74 - Barrett Township Risk Factor Assessment

Barrett Township Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Utility Interruptions (H)	4	2	3	4	4	3.2
	Emergency Services Shortage (H)	4	3	3	1	4	3.2
	Nuclear Incidents (H)	1	4	4	4	4	3.1
	Winter Storms (N)	4	2	3	2	3	2.9
	Windstorms (N)	4	2	3	2	3	2.9
	Wildfire (N)	4	2	2	4	3	2.9
	Dam Failure (H)	3	2	3	3	4	2.8
	Opioid/Substance Abuse (H)	4	3	1	4	1	2.8
	Extreme Temperatures (N)	3	2	4	1	3	2.7
	Pandemic & Infectious Disease (N)	2	2	4	1	4	2.5
	Epidemic (N)	2	2	4	1	4	2.5

Barrett Township Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
	Drowning (H)	4	2	1	4	1	2.5
	Invasive Species (N)	4	2	1	1	4	2.5
MODERATE	Tornadoes (N)	2	2	2	4	4	2.4
	Transportation Accidents (H)	4	1	1	4	2	2.3
	Hazardous Materials - Transportation (H)	3	1	2	4	2	2.2
	Drought (N)	3	1	1	4	4	2.2
	Terrorism – Domestic (H)	2	2	1	4	3	2.1
	Terrorism – International (H)	2	2	1	4	3	2.1
	Cyber Terrorism/Incidents (H)	2	2	1	4	3	2.1
	Hurricane/Tropical Storm (N)	3	1	2	2	2	2
LOW	Disorientation (H)	3	1	1	4	1	1.9
	Flooding (N)	3	1	1	2	3	1.9
	Flash Flooding (N)	3	1	1	3	2	1.9
	Hazardous Materials – Fixed Facilities (H)	2	1	1	4	2	1.7
	Earthquakes (N)	1	1	1	4	4	1.6
	Ice Jam Flooding (N)	1	1	1	1	3	1.2
	Levee Failure (H)	1	1	1	1	1	1

Table 75 - Chestnuthill Township Risk Factor Assessment

Chestnuthill Township Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Utility Interruptions (H)	4	2	3	4	4	3.2
	Winter Storms (N)	4	1	4	1	2	2.6
	Pandemic & Infectious Disease (N)	3	1	4	1	4	2.5

Chestnuthill Township Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
MODERATE	Invasive Species (N)	4	1	2	1	4	2.4
	Hurricane/Tropical Storm (N)	3	1	4	1	3	2.4
	Transportation Accidents (H)	4	1	1	4	1	2.2
	Wildfire (N)	4	1	1	4	1	2.2
	Extreme Temperatures (N)	2	1	4	1	4	2.2
	Hazardous Materials - Transportation (H)	2	2	2	4	2	2.2
	Flash Flooding (N)	2	2	3	1	3	2.2
	Opioid/Substance Abuse (H)	4	1	1	4	1	2.2
	Terrorism – Domestic (H)	1	3	1	4	3	2.1
	Drought (N)	2	1	3	1	4	2
	Hazardous Materials – Fixed Facilities (H)	1	2	2	4	3	2
LOW	Epidemic (N)	1	1	4	1	4	1.9
	Cyber Terrorism/Incidents (H)	2	1	2	4	2	1.9
	Emergency Services Shortage (H)	2	1	2	4	2	1.9
	Windstorms (N)	2	1	2	1	2	1.6
	Dam Failure (H)	1	1	1	4	4	1.6
	Flooding (N)	1	1	2	2	3	1.5
	Terrorism – International (H)	1	1	1	4	2	1.4
	Drowning (H)	1	1	1	4	1	1.3
	Disorientation (H)	1	1	1	4	1	1.3
	Earthquakes (N)	1	1	1	4	1	1.3
	Nuclear Incidents (H)	1	1	1	1	4	1.3
	Tornadoes (N)	1	1	1	3	1	1.2
	Ice Jam Flooding (N)	1	1	1	2	2	1.2
	Levee Failure (H)	1	1	1	1	1	1

Table 76 - Coolbaugh Township Risk Factor Assessment

Coolbaugh Township Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Emergency Services Shortage (H)	4	4	4	4	4	4
	Utility Interruptions (H)	4	3	4	4	4	3.7
	Pandemic & Infectious Disease (N)	3	4	4	3	4	3.6
	Transportation Accidents (H)	4	3	4	4	2	3.5
	Winter Storms (N)	4	3	4	1	3	3.3
	Opioid/Substance Abuse (H)	3	3	3	4	4	3.2
	Invasive Species (N)	4	2	4	1	4	3.1
	Wildfire (N)	4	2	3	4	3	3.1
	Dam Failure (H)	2	4	3	3	3	3
	Drowning (H)	4	3	2	4	1	3
	Flash Flooding (N)	3	3	3	2	2	2.8
	Terrorism – Domestic (H)	3	2	3	4	3	2.8
	Extreme Temperatures (N)	3	2	4	1	3	2.7
	Hazardous Materials - Transportation (H)	3	2	3	4	2	2.7
	Cyber Terrorism/Incidents (H)	3	2	3	4	2	2.7
	Terrorism – International (H)	2	2	3	4	4	2.6
MODERATE	Levee Failure (H)	1	3	3	3	3	2.4
	Drought (N)	2	3	2	1	4	2.4
	Hurricane/Tropical Storm (N)	2	3	2	2	2	2.3
	Disorientation (H)	3	2	2	2	2	2.3
	Epidemic (N)	3	2	2	1	3	2.3
	Windstorms (N)	2	3	2	1	1	2.1
	Flooding (N)	2	2	2	2	3	2.1
	Hazardous Materials – Fixed Facilities (H)	2	2	2	2	2	2
LOW	Tornadoes (N)	1	2	2	2	2	1.7
	Nuclear Incidents (H)	1	1	1	1	1	1
	Ice Jam Flooding (N)	1	1	1	1	1	1
	Earthquakes (N)	1	1	1	1	1	1

Table 77 - Delaware Water Gap Borough Risk Factor Assessment

Delaware Water Gap Borough Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Flash Flooding (N)	4	3	3	3	2	3.2
	Flooding (N)	4	3	3	3	2	3.2
	Drowning (H)	4	3	3	3	1	**3.1**
	Utility Interruptions (H)	4	2	3	4	2	3
	Opioid/Substance Abuse (H)	4	2	2	3	4	2.9
	Ice Jam Flooding (N)	4	2	2	3	2	2.7
	Pandemic & Infectious Disease (N)	3	2	2	4	4	2.7
	Winter Storms (N)	4	1	4	1	3	2.7
	Invasive Species (N)	4	2	3	1	1	2.6
	Extreme Temperatures (N)	4	2	2	1	3	**2.6**
MODERATE	Wildfire (N)	2	2	2	4	4	2.4
	Transportation Accident (H)	3	2	1	4	1	2.2
LOW	Dam Failure (H)	1	1	1	4	4	1.6
	Hazardous Materials – Fixed Facilities (H)	2	1	2	1	1	1.5
	Windstorms (N)	2	1	1	1	2	1.4
	Hazardous Materials - Transportation (H)	2	1	1	1	1	1.3
	Cyber Terrorism/Incidents (H)	2	1	1	1	1	1.3
	Emergency Services Shortage (H)	2	1	1	1	1	1.3
	Terrorism – Domestic (H)	2	1	1	1	1	1.3
	Terrorism – International (H)	2	1	1	1	1	1.3
	Tornadoes (N)	2	1	1	1	1	1.3
	Disorientation (H)	1	1	1	1	1	1
	Drought (N)	1	1	1	1	1	1
	Earthquakes (N)	1	1	1	1	1	1
	Epidemic (N)	1	1	1	1	1	1
	Hurricane/Tropical Storm (N)	1	1	1	1	1	1
	Levee Failure (H)	1	1	1	1	1	1
	Nuclear Incidents (H)	1	1	1	1	1	1

Table 78 - East Stroudsburg Borough Risk Factor Assessment

East Stroudsburg Borough Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic & Infectious Disease (N)	4	4	4	1	4	3.7
	Epidemic (N)	4	4	4	1	4	3.7
	Emergency Services Shortage (H)	4	3	4	4	4	3.7
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Dam Failure (H)	2	4	4	2	4	3.2
	Earthquakes (N)	2	4	4	4	2	3.2
	Tornadoes (N)	3	3	3	4	2	3
	Hazardous Materials – Fixed Facilities (H)	3	3	3	4	2	3
	Hazardous Materials - Transportation (H)	3	3	3	4	2	3
	Winter Storms (N)	5	1	4	1	2	2.9
	Cyber Terrorism/Incidents (H)	3	2	4	4	2	2.9
	Opioid/Substance Abuse (H)	4	3	1	1	4	2.8
	Extreme Temperatures (N)	2	3	4	1	3	2.7
	Terrorism – Domestic (H)	3	3	2	4	1	2.7
	Transportation Accidents (H)	3	3	1	4	1	2.5
	Invasive Species (N)	3	1	4	1	4	2.5
	Flash Flooding (N)	3	2	2	4	2	2.5
MODERATE	Levee Failure (H)	1	3	3	1	4	2.3
	Drowning (H)	2	3	1	4	1	2.2
	Windstorms (N)	3	1	3	2	2	2.2
	Drought (N)	2	1	4	1	4	2.2
	Terrorism – International (H)	1	3	2	4	2	2.2
	Hurricane/Tropical Storm (N)	3	1	3	1	2	2.1
LOW	Flooding (N)	2	1	2	2	3	1.8
	Nuclear Incidents (H)	1	1	1	4	3	1.5
	Wildfire (N)	1	1	1	4	1	1.3
	Ice Jam Flooding (N)	1	1	1	1	3	1.2
	Disorientation (H)	1	1	1	1	1	1

Table 79 - Eldred Township Risk Factor Assessment

Eldred Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Transportation Accidents (H)	4	4	4	4	4	4
	Emergency Services Shortage (H)	4	4	4	4	4	4
	Pandemic & Infectious Disease (N)	4	4	3	1	4	3.5
	Wildfire (N)	4	3	3	4	3	3.4
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Winter Storms (N)	4	3	3	1	3	3.1
	Nuclear Incidents (H)	1	4	4	4	4	3.1
	Drought (N)	3	3	2	1	4	2.7
MODERATE	Flash Flooding (N)	3	2	2	3	2	2.4
	Dam Failure (H)	3	2	2	3	1	2.3
	Hazardous Materials - Transportation (H)	2	3	2	2	2	2.3
	Opioid/Substance Abuse (H)	3	2	2	1	2	2.2
	Hurricane/Tropical Storm (N)	2	2	2	1	3	2
	Flooding (N)	2	2	2	1	3	2
	Terrorism – Domestic (H)	2	2	2	2	2	2
LOW	Invasive Species (N)	2	2	2	1	2	1.9
	Epidemic (N)	2	2	2	1	2	1.9
	Tornadoes (N)	2	2	2	1	2	1.9
	Windstorms (N)	2	2	2	1	2	1.9
	Extreme Temperatures (N)	2	2	1	1	1	1.6
	Drowning (H)	1	1	1	1	1	1
	Disorientation (H)	1	1	1	1	1	1
	Hazardous Materials – Fixed Facilities (H)	1	1	1	1	1	1
	Ice Jam Flooding (N)	1	1	1	1	1	1
	Earthquakes (N)	1	1	1	1	1	1
	Terrorism – International (H)	1	1	1	1	1	1
	Cyber Terrorism/Incidents (H)	1	1	1	1	1	1
	Levee Failure (H)	1	1	1	1	1	1

Table 80 - Hamilton Township Risk Factor Assessment

Hamilton Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic & Infectious Disease (N)	4	3	4	1	4	3.4
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Opioid/Substance Abuse (H)	4	3	3	1	4	3.2
	Invasive Species (N)	4	2	4	1	4	3.1
	Epidemic (N)	3	3	4	1	4	3.1
	Hurricane/Tropical Storm (N)	3	3	4	2	3	3.1
	Flooding (N)	3	3	3	3	3	3
	Earthquakes (N)	2	3	4	4	3	3
	Emergency Services Shortage (H)	3	2	4	3	4	3
	Windstorms (N)	3	2	4	3	3	2.9
	Flash Flooding (N)	3	3	2	4	3	2.9
	Wildfire (N)	3	2	3	4	3	2.8
	Drought (N)	3	2	4	1	4	2.8
	Hazardous Materials - Transportation (H)	3	3	2	4	2	2.8
	Winter Storms (N)	3	1	4	2	3	2.7
	Tornadoes (N)	2	3	3	4	2	2.7
	Cyber Terrorism/Incidents (H)	3	2	2	4	4	2.7
	Disorientation (H)	3	3	1	4	2	2.6
	Hazardous Materials – Fixed Facilities (H)	2	3	2	4	3	2.6
	Transportation Accidents (H)	4	1	2	4	2	2.5
	Nuclear Incidents (H)	1	2	4	4	4	2.5
MODERATE	Extreme Temperatures (N)	3	1	4	1	3	2.4
	Terrorism – Domestic (H)	1	3	2	4	3	2.3
	Dam Failure (H)	2	2	2	4	2	2.2
	Ice Jam Flooding (N)	2	2	2	3	3	2.2
	Terrorism – International (H)	1	3	1	4	3	2.1
LOW	Drowning (H)	2	2	1	4	1	1.9
	Levee Failure (H)	1	1	2	4	3	1.7

Table 81 - Jackson Township Risk Factor Assessment

Jackson Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Utility Interruptions (H)	4	2	3	3	3	3
	Emergency Services Shortage (H)	4	3	4	1	4	3.4
	Winter Storms (N)	4	3	4	1	2	3.2
	Pandemic & Infectious Disease (N)	3	3	4	1	4	3.1
	Nuclear Incidents (H)	1	4	4	4	4	3.1
	Earthquakes (N)	1	3	4	4	4	2.8
	Flash Flooding (N)	3	2	3	3	2	2.6
	Flooding (N)	3	2	3	2	2	2.5
	Transportation Accidents (H)	4	2	1	4	1	2.5
	Epidemic (N)	1	3	4	1	4	2.5
	Opioid/Substance Abuse (H)	4	2	1	4	1	2.5
MODERATE	Dam Failure (H)	2	2	3	3	3	2.4
	Hurricane/Tropical Storm (N)	2	2	4	1	3	2.4
	Windstorms (N)	2	2	4	2	2	2.4
	Wildfire (N)	4	1	2	4	1	2.4
	Invasive Species (N)	3	1	3	1	4	2.3
	Drought (N)	2	1	4	1	4	2.2
	Levee Failure (H)	1	2	3	3	3	2.1
	Extreme Temperatures (N)	2	1	4	1	3	2.1
	Disorientation (H)	3	1	1	4	2	2
LOW	Drowning (H)	2	2	1	4	1	1.9
	Tornadoes (N)	1	2	2	3	1	1.7
	Hazardous Materials – Fixed Facilities (H)	1	2	1	4	2	1.7
	Hazardous Materials - Transportation (H)	1	2	1	4	2	1.7
	Terrorism – Domestic (H)	2	1	1	4	2	1.7
	Ice Jam Flooding (N)	1	2	2	2	2	1.7
	Terrorism – International (H)	1	1	1	4	2	1.4
	Cyber Terrorism/Incidents (H)	1	1	1	4	2	1.4

Table 82 - Mount Pocono Borough Risk Factor Assessment

Mount Pocono Borough Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Opioid/Substance Abuse (H)	4	3	4	1	4	3.4
	Emergency Services Shortage (H)	4	3	4	1	4	3.4
	Terrorism – Domestic (H)	3	3	4	4	3	3.3
	Cyber Terrorism/Incidents (H)	3	3	4	4	3	3.3
	Utility Interruptions (H)	4	2	3	4	3	3.1
	Pandemic & Infectious Disease (N)	3	3	4	1	4	3.1
	Extreme Temperatures (N)	4	2	4	1	4	3.1
	Epidemic (N)	3	3	4	1	4	3.1
	Winter Storms (N)	4	2	4	2	2	3
	Windstorms (N)	4	2	4	2	2	3
	Terrorism – International (H)	2	3	4	4	3	3
	Hazardous Materials - Transportation (H)	4	3	1	4	3	3
	Hazardous Materials – Fixed Facilities (H)	3	3	2	4	3	2.9
	Wildfire (N)	3	2	3	4	3	2.8
	Invasive Species (N)	4	1	4	1	4	2.8
MODERATE	Transportation Accidents (H)	4	1	1	4	1	2.2
	Flooding (N)	3	1	2	3	3	2.2
	Drought (N)	2	1	4	1	4	2.2
	Dam Failure (H)	4	1	1	3	2	2.2
	Tornadoes (N)	2	2	2	4	1	2.1
	Hurricane/Tropical Storm (N)	2	2	3	1	2	2.1
LOW	Drowning (H)	2	1	1	4	1	1.6
	Flash Flooding (N)	2	1	1	3	1	1.5
	Earthquakes (N)	1	1	1	4	1	1.3
	Nuclear Incidents (H)	1	1	1	1	1	1
	Levee Failure (H)	1	1	1	1	1	1
	Ice Jam Flooding (N)	1	1	1	1	1	1
	Disorientation (H)	1	1	1	1	1	1

Table 83 - Paradise Township Risk Factor Assessment

Paradise Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic & Infectious Disease (N)	4	4	4	4	4	4
	Epidemic (N)	4	4	4	4	4	4
	Winter Storms (N)	4	2	3	4	3	3.1
	Terrorism – Domestic (H)	2	4	3	4	2	3
	Nuclear Incidents (H)	1	4	4	3	4	3
	Utility Interruptions (H)	4	1	3	4	3	2.8
	Earthquakes (N)	1	4	4	3	2	2.8
	Hazardous Materials – Fixed Facilities (H)	1	4	3	4	2	2.7
	Hazardous Materials - Transportation (H)	1	4	3	4	2	2.7
	Opioid/Substance Abuse (H)	3	2	1	4	4	2.5
MODERATE	Windstorms (N)	3	2	3	1	2	2.4
	Terrorism – International (H)	1	3	3	4	2	2.4
	Cyber Terrorism/Incidents (H)	2	2	3	4	2	2.4
	Transportation Accidents (H)	4	2	2	1	1	2.4
	Drought (N)	1	3	3	1	4	2.3
	Emergency Services Shortage (H)	2	2	3	1	4	2.3
	Tornadoes (N)	1	3	3	1	2	2.1
	Flooding (N)	2	2	2	3	2	2.1
	Flash Flooding (N)	2	2	2	3	2	2.1
	Ice Jam Flooding (N)	2	2	2	3	2	2.1
	Invasive Species (N)	2	1	2	4	4	2.1
	Extreme Temperatures (N)	2	2	2	2	2	2
LOW	Drowning (H)	1	2	2	4	2	1.9
	Wildfire (N)	2	1	3	1	2	1.8
	Hurricane/Tropical Storm (N)	1	2	3	1	2	1.8
	Disorientation (H)	1	1	2	3	2	1.5
	Dam Failure (H)	1	1	2	1	3	1.4
	Levee Failure (H)	1	1	1	1	1	1

Table 84 - Pocono Township Risk Factor Assessment

Pocono Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Utility Interruptions (H)	4	3	4	4	4	3.7
	Pandemic & Infectious Disease (N)	3	4	4	1	4	3.4
	Winter Storms (N)	4	3	4	1	3	3.3
	Emergency Services Shortage (H)	3	3	4	4	2	3.2
	Flooding (N)	4	2	3	3	3	3
	Invasive Species (N)	4	1	4	1	4	2.8
	Terrorism – Domestic (H)	3	2	3	4	3	2.8
	Extreme Temperatures (N)	3	2	4	1	3	2.7
	Flash Flooding (N)	4	2	2	3	2	2.7
	Transportation Accidents (H)	4	2	2	4	1	2.7
	Terrorism – International (H)	2	2	3	4	4	2.6
	Hurricane/Tropical Storm (N)	2	3	3	1	3	2.5
	Hazardous Materials - Transportation (H)	3	2	2	4	2	2.5
	Cyber Terrorism/Incidents (H)	2	2	3	4	3	2.5
MODERATE	Dam Failure (H)	2	2	3	3	3	2.4
	Windstorms (N)	4	1	1	4	2	2.3
	Epidemic (N)	3	2	2	1	3	2.3
	Nuclear Incidents (H)	1	2	3	4	4	2.3
	Wildfire (N)	3	1	2	4	2	2.2
	Drought (N)	2	1	4	1	4	2.2
	Opioid/Substance Abuse (H)	3	1	2	1	4	2.1
	Hazardous Materials – Fixed Facilities (H)	1	2	2	4	3	2
LOW	Drowning (H)	2	2	1	4	1	1.9
	Tornadoes (N)	2	2	1	4	1	1.9
	Earthquakes (N)	1	1	3	4	1	1.7
	Disorientation (H)	1	1	1	4	2	1.4
	Ice Jam Flooding (N)	1	1	1	2	2	1.2
	Levee Failure (H)	1	1	1	1	1	1

Table 85 - Polk Township Risk Factor Assessment

Polk Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic & Infectious Disease (N)	4	4	4	1	4	3.7
	Winter Storms (N)	4	3	4	2	2	3.3
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Drought (N)	3	3	4	1	4	3.1
	Flooding (N)	3	3	3	3	3	3
	Invasive Species (N)	4	2	3	1	4	2.9
	Tornadoes (N)	2	3	3	4	2	2.7
	Hurricane/Tropical Storm (N)	2	3	3	3	2	2.6
	Flash Flooding (N)	3	2	3	3	2	2.6
	Hazardous Materials - Transportation (H)	3	2	2	4	3	2.6
	Wildfire (N)	3	2	2	4	2	2.5
MODERATE	Extreme Temperatures (N)	3	2	2	2	3	2.4
	Opioid/Substance Abuse (H)	3	2	2	4	1	2.4
	Transportation Accidents (H)	4	2	1	1	2	2.3
	Nuclear Incidents (H)	2	1	3	4	2	2.1
	Windstorms (N)	2	2	2	3	1	2
	Hazardous Materials – Fixed Facilities (H)	2	2	2	2	2	2
	Cyber Terrorism/Incidents (H)	2	2	2	3	1	2
LOW	Disorientation (H)	2	2	2	1	2	1.9
	Earthquakes (N)	1	2	2	4	1	1.8
	Terrorism – Domestic (H)	1	2	2	3	1	1.7
	Terrorism – International (H)	1	2	2	3	1	1.7
	Drowning (H)	2	1	1	4	1	1.6
	Emergency Services Shortage (H)	1	1	1	2	4	1.4
	Dam Failure (H)	1	1	1	3	2	1.3
	Epidemic (N)	1	1	1	1	4	1.3
	Levee Failure (H)	1	1	1	2	2	1.2
	Ice Jam Flooding (N)	1	1	1	2	1	1.1

Table 86 - Price Township Risk Factor Assessment

Price Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Winter Storms (N)	4	2	4	4	2	3.2
	Utility Interruptions (H)	4	2	3	4	1	2.9
	Transportation Accidents (H)	4	3	1	4	1	2.8
	Invasive Species (N)	4	2	1	1	4	2.5
MODERATE	Pandemic & Infectious Disease (N)	2	2	3	1	4	2.3
	Epidemic (N)	2	2	3	1	4	2.3
	Disorientation (H)	1	1	1	4	11	2.3
	Wildfire (N)	2	2	2	4	1	2.1
	Flash Flooding (N)	2	2	2	4	1	2.1
LOW	Dam Failure (H)	2	2	2	1	2	1.9
	Windstorms (N)	2	2	2	1	2	1.9
	Opioid/Substance Abuse (H)	3	2	1	1	1	1.9
	Drowning (H)	1	2	1	4	1	1.6
	Tornadoes (N)	1	2	1	4	1	1.6
	Hurricane/Tropical Storm (N)	1	2	1	1	3	1.5
	Hazardous Materials - Transportation (H)	1	1	1	4	2	1.4
	Flooding (N)	1	2	1	1	2	1.4
	Hazardous Materials – Fixed Facilities (H)	1	1	1	4	1	1.3
	Ice Jam Flooding (N)	1	1	1	4	1	1.3
	Emergency Services Shortage (H)	2	1	1	1	1	1.3
	Extreme Temperatures (N)	1	1	1	1	3	1.2
	Drought (N)	1	1	1	1	3	1.2
	Earthquakes (N)	1	1	1	1	2	1.1
	Terrorism – International (H)	1	1	1	1	2	1.1
	Levee Failure (H)	1	1	1	1	1	1
	Nuclear Incidents (H)	1	1	1	1	1	1
	Terrorism – Domestic (H)	1	1	1	1	1	1
	Cyber Terrorism/Incidents (H)	1	1	1	1	1	1

Table 87 - Ross Township Risk Factor Assessment

Ross Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
MODERATE	Transportation Accidents (H)	3	2	1	4	1	2.2
	Extreme Temperatures (N)	2	1	4	1	3	2.1
LOW	Emergency Services Shortage (H)	3	1	1	1	1	1.6
	Drought (N)	2	1	1	1	3	1.5
	Windstorms (N)	2	1	1	1	1	1.3
	Hazardous Materials - Transportation (H)	2	1	1	1	1	1.3
	Flooding (N)	2	1	1	1	1	1.3
	Flash Flooding (N)	2	1	1	1	1	1.3
	Opioid/Substance Abuse (H)	2	1	1	1	1	1.3
	Terrorism – Domestic (H)	2	1	1	1	1	1.3
	Terrorism – International (H)	2	1	1	1	1	1.3
	Cyber Terrorism/Incidents (H)	2	1	1	1	1	1.3
	Invasive Species (N)	1	1	1	1	1	1
	Dam Failure (H)	1	1	1	1	1	1
	Levee Failure (H)	1	1	1	1	1	1
	Drowning (H)	1	1	1	1	1	1
	Hurricane/Tropical Storm (N)	1	1	1	1	1	1
	Tornadoes (N)	1	1	1	1	1	1
	Nuclear Incidents (H)	1	1	1	1	1	1
	Disorientation (H)	1	1	1	1	1	1
	Ice Jam Flooding (N)	1	1	1	2	1	1.1
	Earthquakes (N)	1	1	1	1	1	1

Table 88 - Smithfield Township Risk Factor Assessment

Smithfield Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Opioid/Substance Abuse (H)	4	4	4	1	4	3.7
	Winter Storms (N)	4	3	4	1	3	3.3
	Hurricane/Tropical Storm (N)	4	3	4	1	3	3.3
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Invasive Species (N)	4	2	4	1	4	3.1
	Epidemic (N)	2	4	4	1	4	3.1
	Pandemic & Infectious Disease (N)	1	4	4	1	4	2.8
	Emergency Services Shortage (H)	4	1	4	1	4	2.8
	Extreme Temperatures (N)	3	2	4	1	3	2.7
	Flooding (N)	4	2	2	2	3	2.7
	Transportation Accidents (H)	4	2	2	4	1	2.7
	Flash Flooding (N)	4	2	2	4	1	2.7
	Windstorms (N)	3	2	3	3	2	2.6
	Levee Failure (H)	1	4	2	3	3	2.5
	Drowning (H)	4	2	1	4	1	2.5
MODERATE	Wildfire (N)	2	2	2	4	3	2.3
	Nuclear Incidents (H)	1	2	3	4	4	2.3
	Dam Failure (H)	1	3	2	3	3	2.2
	Drought (N)	2	1	4	1	4	2.2
	Disorientation (H)	4	1	1	4	1	2.2
	Cyber Terrorism/Incidents (H)	4	1	1	4	1	2.2
	Tornadoes (N)	2	3	1	3	1	2.1
	Hazardous Materials – Fixed Facilities (H)	2	2	1	4	3	2.1
LOW	Earthquakes (N)	1	1	4	4	1	1.9
	Terrorism – Domestic (H)	1	2	1	4	4	1.9
	Terrorism – International (H)	1	2	1	4	3	1.8
	Hazardous Materials - Transportation (H)	2	1	1	4	1	1.6
	Ice Jam Flooding (N)	1	1	1	2	2	1.2

Table 89 - Stroud Township Risk Factor Assessment

Stroud Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Windstorms (N)	4	4	2	2	4	3.7
	Utility Interruptions (H)	4	2	3	4	3	3.3
	Nuclear Incidents (H)	1	3	4	4	3	3.3
	Drought (N)	4	1	4	1	4	3.2
	Extreme Temperatures (N)	3	2	4	1	4	3.1
MODERATE	Transportation Accidents (H)	4	1	2	4	1	2.4
	Invasive Species (N)	4	1	2	1	4	2.4
	Emergency Services Shortage (H)	4	1	2	1	4	2.4
	Pandemic & Infectious Disease (N)	2	2	3	1	4	2.3
	Flooding (N)	4	1	2	2	2	2.3
	Cyber Terrorism/Incidents (H)	4	1	1	4	2	2.3
	Hazardous Materials – Fixed Facilities (H)	2	2	2	4	3	2.3
	Winter Storms (N)	4	1	2	1	2	2.2
	Disorientation (H)	4	1	1	1	4	2.2
	Hazardous Materials - Transportation (H)	2	2	2	4	2	2.2
	Flash Flooding (N)	4	1	1	3	2	2.2
	Terrorism – Domestic (H)	2	2	2	4	2	2.2
	Wildfire (N)	2	2	2	4	1	2.1
	Dam Failure (H)	2	2	2	2	3	2.1
	Hurricane/Tropical Storm (N)	2	2	3	1	2	2.1
	Tornadoes (N)	2	2	2	4	1	2.1
	Terrorism – International (H)	1	2	3	4	2	2.1
	Earthquakes (N)	2	1	3	4	1	2
LOW	Drowning (H)	2	2	2	1	1	1.8
	Epidemic (N)	2	1	2	1	4	1.8
	Levee Failure (H)	1	2	2	1	3	1.7
	Opioid/Substance Abuse (H)	3	1	1	1	1	1.6
	Ice Jam Flooding (N)	2	1	1	1	2	1.4

Table 90 - Stroudsburg Borough Risk Factor Assessment

Stroudsburg Borough Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Transportation Accidents (H)	4	4	4	4	4	4
	Pandemic & Infectious Disease (N)	4	4	4	4	4	4
	Hurricane/Tropical Storm (N)	4	4	4	4	4	4
	Hazardous Materials - Transportation (H)	4	4	4	4	4	4
	Flooding (N)	4	4	4	4	4	4
	Flash Flooding (N)	4	4	4	4	4	4
	Opioid/Substance Abuse (H)	4	4	4	4	4	4
	Cyber Terrorism/Incidents (H)	4	4	4	4	4	4
	Utility Interruptions (H)	4	3.5	4	4	4	3.85
	Windstorms (N)	4	4	4	4	2	3.8
	Tornadoes (N)	3	4	4	4	4	3.7
	Drought (N)	3	4	4	4	3	3.6
	Invasive Species (N)	4	3	4	1	4	3.4
	Epidemic (N)	2	4	4	4	4	3.4
	Hazardous Materials – Fixed Facilities (H)	2	4	4	4	4	3.4
	Earthquakes (N)	2	4	4	4	4	3.4
	Terrorism – Domestic (H)	2	4	4	4	4	3.4
	Terrorism – International (H)	2	4	4	4	4	3.4
	Emergency Services Shortage (H)	2	4	4	4	4	3.4
	Winter Storms (N)	4	3	3	3	3	3.3
	Extreme Temperatures (N)	4	2	4	4	2	3.2
	Drowning (H)	4	2	4	4	2	3.2
	Levee Failure (H)	1	4	4	4	4	3.1
	Nuclear Incidents (H)	1	4	4	4	4	3.1
	Dam Failure (H)	1	4	2	4	4	2.7
MODERATE	Wildfire (N)	2	2	4	2	2	2.4
	Ice Jam Flooding (N)	2	2	2	2	2	2
LOW	Disorientation (H)	1	1	1	1	1	1

Table 91 - Tobyhanna Township Risk Factor Assessment

Tobyhanna Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Emergency Services Shortage (H)	4	4	4	4	4	4
	Transportation Accidents (H)	4	3	3	4	1	3.2
	Utility Interruptions (H)	4	2	3	4	3	3.1
	Pandemic & Infectious Disease (N)	4	2	4	1	4	3.1
	Winter Storms (N)	4	2	4	1	3	3
	Wildfire (N)	4	2	3	4	1	2.9
	Hazardous Materials - Transportation (H)	4	2	3	4	1	2.9
	Opioid/Substance Abuse (H)	4	1	4	1	4	2.8
	Extreme Temperatures (N)	3	2	4	1	3	2.7
	Terrorism – Domestic (H)	3	2	2	4	4	2.7
	Invasive Species (N)	2	2	4	1	4	2.5
	Drought (N)	2	2	4	1	4	2.5
MODERATE	Windstorms (N)	3	2	3	1	2	2.4
	Terrorism – International (H)	2	2	2	4	4	2.4
	Cyber Terrorism/Incidents (H)	3	1	2	4	4	2.4
	Dam Failure (H)	2	2	2	4	3	2.3
	Drowning (H)	4	1	1	4	1	2.2
	Hurricane/Tropical Storm (N)	2	1	4	1	3	2.1
LOW	Levee Failure (H)	2	1	1	4	4	1.9
	Disorientation (H)	2	2	1	4	1	1.9
	Epidemic (N)	2	1	2	1	4	1.8
	Tornadoes (N)	2	1	1	3	3	1.7
	Flooding (N)	2	1	2	1	3	1.7
	Flash Flooding (N)	2	1	2	2	2	1.7
	Ice Jam Flooding (N)	2	1	2	2	2	1.7
	Hazardous Materials – Fixed Facilities (H)	2	1	1	4	1	1.6
	Nuclear Incidents (H)	1	1	1	4	1	1.3
	Earthquakes (N)	1	1	1	4	1	1.3

Table 92 - Tunkhannock Township Risk Factor Assessment

Tunkhannock Township Hazard Ranking Based on RF Methodology							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Winter Storms (N)	4	3	4	1	4	3.4
	Invasive Species (N)	4	3	4	1	4	3.4
	Cyber Terrorism/Incidents (H)	3	3	4	4	4	3.4
	Emergency Services Shortage (H)	4	3	4	1	4	3.4
	Utility Interruptions (H)	4	2	3	4	4	3.2
	Wildfire (N)	3	3	3	4	3	3.1
	Hurricane/Tropical Storm (N)	3	3	4	1	4	3.1
	Flash Flooding (N)	3	3	3	4	1	2.9
	Hazardous Materials - Transportation (H)	4	2	2	4	2	2.8
	Flooding (N)	3	3	3	1	2	2.7
	Transportation Accidents (H)	4	2	2	4	1	2.7
	Dam Failure (H)	2	3	2	4	4	2.7
	Windstorms (N)	3	2	4	1	2	2.6
MODERATE	Drought (N)	2	2	2	4	4	2.4
	Hazardous Materials – Fixed Facilities (H)	2	2	2	4	3	2.3
	Pandemic & Infectious Disease (N)	1	3	2	1	4	2.1
	Epidemic (N)	1	3	2	1	4	2.1
	Ice Jam Flooding (N)	2	2	2	2	3	2.1
	Disorientation (H)	3	1	1	4	2	2
LOW	Tornadoes (N)	2	1	1	4	3	1.8
	Extreme Temperatures (N)	1	2	2	1	3	1.7
	Nuclear Incidents (H)	1	2	1	4	2	1.7
	Levee Failure (H)	1	1	2	1	4	1.5
	Terrorism – Domestic (H)	2	1	1	3	1	1.5
	Drowning (H)	1	1	1	4	1	1.3
	Earthquakes (N)	1	1	1	4	1	1.3
	Opioid/Substance Abuse (H)	1	1	1	4	1	1.3
	Terrorism – International (H)	1	1	1	3	1	1.2

4.4.3. Potential Loss Estimates

Based on various kinds of available data, potential loss estimates were established for flooding. Estimates provided in this section are based on HAZUS-MH, version MR4, geospatial analysis, and previous events. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

Replacement Value: Current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials.

Content Loss: Value of building's contents, typically measured as a percentage of the building replacement value.

Functional Loss: The value of a building's use or function that would be lost if it were damaged or closed.

Displacement Cost: The dollar amount required for relocation of the function (business or service) to another structure following a hazard event.

Flooding Loss Estimation:

Flooding is a high-risk natural hazard in Monroe County. The estimation of potential loss in this assessment focuses on the monetary damage that could result from flooding. The potential property loss was determined for each municipality and for the entire county. The quantity of commercial and residential structures in each Monroe County municipality is outlined in section 4.3.4 of the flooding hazard profile.

MCM Consulting Group, Inc. conducted a countywide flood study using the Hazards U.S. Multi-Hazard (HAZUS-MH) software that is provided by the Federal Emergency Management Agency. This software is a standardized loss estimation software deriving economic loss, building damage, content damage and other economic impacts that can be used in local flood mitigation planning activities.

Using HAZUS-MH, total building-related losses from a 1%-annual-chance flood in Monroe County are estimated to equal $288.56 million with 34.69% of that coming from residential homes. Total economic loss, including replacement value, content loss, functional loss, and displacement cost, from a countywide 1%-annual-chance flood are estimated to equal $539.98 million.

4.4.4. Future Development and Vulnerability

The 2019 estimated population for Monroe County is 170,271 which is 429 more than the 2010 census. There was an overall increase of 0.2% in population based on the estimate. Nine municipalities have seen population increases while the remaining had decreases in the period

between 2010 and the 2019 estimate as identified in *Table 93 – Population Change in Monroe County from 2010-2019.* Population data after the year 2019 was unavailable during the writing of this plan.

Table 93 - Population Change in Monroe County from 2010-2019

Population Change in Monroe County from 2010-2019				
Municipality	**2010 Census**	**2015 Estimates**	**2019 Estimates**	**Percent of Change 2010-2019 Estimate**
Barrett Township	4,225	4,076	4,142	-2.0%
Chestnuthill Township	17,156	16,686	17,000	-1.0%
Coolbaugh Township	20,564	20,162	20,599	+1.7%
Delaware Water Gap Borough	746	721	752	+8.0%
East Stroudsburg Borough	9,840	10,274	10,433	+6.0%
Eldred Township	2,910	2,829	2,869	-1.4%
Hamilton Township	9,083	8,800	8,966	-1.3%
Jackson Township	7,033	6,812	6,933	-1.4%
Middle Smithfield Township	15,997	15,603	15,942	-3.4%
Mount Pocono Borough	3,170	3,072	3,119	-1.6%
Paradise Township	3,186	3,085	3,136	-1.5%
Pocono Township	11,065	10,798	11,089	+2.2%
Polk Township	7,874	7,634	7,779	-1.2%
Price Township	3,573	3,557	3,716	+4.0%
Ross Township	5,940	5,799	5,925	-2.5%
Smithfield Township	7,357	7,372	7,558	+2.7%
Stroud Township	19,213	18,678	19,361	+7.7%
Stroudsburg Borough	5,567	5,469	5,558	-1.6%
Tobyhanna Township	8,554	8,377	8,599	+5.2%
Tunkhanock Township	6,789	6,677	6,795	+0.9%
TOTAL	**169,842**	**166,481**	**170,271**	**+0.2%**

5. Capability Assessment

5.1. Update Process Summary

The capability assessment is an evaluation of Monroe County's governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and ordinances and resource availability. Each category is evaluated for its strengths and weaknesses in responding to, preparing for, and mitigating the effects of the profiled hazards. A capability assessment is an integral part of the hazard mitigation planning process. Here, the county and municipalities identify, review, and analyze what they are currently doing to reduce losses and identify the framework necessary to implement new mitigation actions. This information will help the county and municipalities evaluate alternative mitigation actions and address shortfalls in the mitigation plan.

A capabilities assessment survey was provided to the municipalities during the planning process at meetings held with Monroe County officials. These meetings were designed to seek input from key county and municipal stakeholders on legal, fiscal, technical, and administrative capabilities of all jurisdictions. As such, the capabilities assessment helps guide the implementation of mitigation projects and will help evaluate the effectiveness of existing mitigation measures, policies, plans, practices, and programs.

Throughout the planning process, the mitigation local planning team considered the county's twenty municipalities. Pennsylvania municipalities have their own governing bodies, pass and enforce their own ordinances and regulations, purchase equipment and manage their own resources, including critical infrastructure. These capability assessments, therefore, consider the various characteristics and capabilities of municipalities under study.

The evaluation of the following categories – political framework, legal jurisdiction, fiscal status, policies and programs, and regulations and ordinances – allows the mitigation planning team to determine the viability of certain mitigation actions. The capability assessment analyzes what Monroe County and its municipalities have the capacity to do and provides an understanding of what must be changed to mitigate loss.

Monroe County has a number of resources it can access to implement hazard mitigation initiatives including emergency response measures, local planning and regulatory tools, administrative assistance and technical expertise, fiscal capabilities and participation in local, regional, state and federal programs. The presence of these resources enables community resiliency through actions taken before, during and after a hazardous event. While the capability assessment serves as a good instrument for identifying local capabilities, it also provides a means for recognizing gaps and weaknesses that can be resolved through future mitigation actions. The

results of this assessment lend critical information for developing an effective mitigation strategy.

5.2. Capability Assessment Findings

All twenty municipalities in Monroe County completed and submitted a capability assessment survey. The results of the survey were collected, aggregated, and analyzed.

5.2.1. Planning and Regulatory Capability

Municipalities have the authority to govern more restrictively than state and county minimum requirements as long as they are compliant with all criteria established in the Pennsylvania Municipalities Planning Code (MPC) and their respective municipal codes. Municipalities can develop their own policies and programs and implement their own rules and regulations to protect and serve their local residents. Local policies and programs are typically identified in a comprehensive plan, implemented through a local ordinance, and enforced by the governmental body or its appointee.

Municipalities regulate land use via the adoption and enforcement of zoning, subdivision, and land development, building codes, building permits, floodplain management and/or stormwater management ordinances. When effectively prepared and administered, these regulations can lead to an opportunity for hazard mitigation. For example, the National Flood Insurance Program (NFIP) established minimum floodplain management criteria. Adoption of the Pennsylvania Floodplain Management Act (Act 166 of 1978) established higher standards. A municipality must adopt and enforce these minimum criteria to be eligible for participation in the NFIP. Municipalities have the option of adopting a single-purpose ordinance or incorporating these provisions into their zoning, subdivision and land development, or building codes; thereby mitigating the potential impacts of local flooding. This capability assessment details the existing Monroe County and municipal legal capabilities to mitigate the profiled hazards. It identifies the county's and the municipalities' existing planning documents and their hazard mitigation potential. Hazard mitigation recommendations are, in part, based on the information contained in the assessment.

Building Codes

Building codes are important in mitigation because they are developed for a region of the country in respect to the hazards existing in that area. Consequently, structures that are built according to applicable codes are inherently resistant to many hazards, such as strong winds, floods, and earthquakes; and can help mitigate regional hazards, such as wildfires. In 2003, Pennsylvania implemented the Uniform Construction Code (UCC) (Act 45), a comprehensive building code that establishes minimum regulations for most new construction, including additions and renovations to existing structures.

The code applies to almost all buildings, excluding manufactured and industrialized housing (which are covered by other laws), agricultural buildings and certain utility and miscellaneous buildings. The UCC has many advantages. It requires builders to use materials and methods that have been professionally evaluated for quality and safety, as well as inspections to ensure compliance.

The initial election period, during which all of Pennsylvania's 2,565 municipalities were allowed to decide whether the UCC would be administered and enforced locally, officially closed on August 7, 2004. The codes adopted for use under the UCC are the 2003 International Codes issued by the International Code Council (ICC). Supplements to the 2003 codes have been adopted for use over the years since.

If a municipality has "opted in", all UCC enforcement is local, except where municipal (or third party) code officials lack the certification necessary to approve plans and inspect commercial construction for compliance with UCC accessibility requirements. If a municipality has "opted out", the PA Department of Labor and Industry is responsible for all commercial code enforcement in that municipality; and all residential construction is inspected by independent third-party agencies selected by the owner. The department also has sole jurisdiction for all state-owned buildings no matter where they are located. Historical buildings may be exempt from such inspections and Act 45 provides quasi-exclusion from UCC requirements.

The municipalities in Monroe County adhere to the standards of the Pennsylvania Uniform Construction Code (Act 45). All municipalities in Monroe County have opted-in on building code enforcement.

Zoning Ordinance

Article VI of the Municipalities Planning Code (MPC) authorizes municipalities to prepare and enact zoning to regulate land use. Its regulations can apply to the permitted use of land; the height and bulk of structures; the percentage of a lot that may be occupied by buildings and other impervious surfaces; yard setbacks; the density of development; the height and size of signs; the parking regulations. A zoning ordinance has two parts, including the zoning map that delineates zoning districts and the text that sets forth the regulations that apply to each district. All twenty municipalities in Monroe County have their own zoning regulations.

Subdivision Ordinance

Subdivision and land development ordinances include regulations to control the layout of streets, the planning of lots and the provision of utilities and other site improvements. The objectives of a subdivision and land development ordinance are to: coordinate street patterns; assure adequate utilities and other improvements are provided in a manner that will not pollute streams, wells

and/or soils; reduce traffic congestion; and provide sound design standards as a guide to developers, the elected officials, planning commissions and other municipal officials. Article V of the Municipality Planning Code authorizes municipalities to prepare and enact a subdivision and land development ordinance. Subdivision and land development ordinances provide for the division and improvement of land. All municipalities in Monroe County utilize some form of land use and land development regulation.

Stormwater Management Plan/Stormwater Ordinance

The proper management of stormwater runoff can improve conditions and decrease the chance of flooding. Pennsylvania's Stormwater Management Act (Act 167) confers on counties the responsibility for development of watershed plans. The act specifies that counties must complete their watershed stormwater plans within two years following the promulgation of these guidelines by the DEP, which may grant an extension of time to any county for the preparation and adoption of plans. Counties must prepare the watershed plans in consultation with municipalities and residents. This is to be accomplished through the establishment of a watershed plan advisory committee. The counties must also establish a mechanism to periodically review and revise watershed plans, so they are current. Plan revisions must be done every five years or sooner, if necessary.

Municipalities have an obligation to implement the criteria and standards developed in each watershed stormwater management plan by amending or adopting laws and regulation for land use and development. The implementation of stormwater management criteria and standards at the local level are necessary since municipalities are responsible for local land use decisions and planning. The degree of detail in the ordinances depends on the extent of existing and projected development. The watershed stormwater management plan is designed to aid the municipality in setting standards for the land uses it has proposed. Municipalities within rapidly developing watersheds will benefit from the watershed stormwater management plan and will use the information for sound land use considerations. A major goal of the watershed plan and the attendant municipal regulations is to prevent future drainage problems and avoid the aggravation of existing problems. All municipalities in Monroe County have adopted the county's stormwater management plan.

Comprehensive Plan

A comprehensive plan is a policy document that states objectives and guides the future growth and physical development of a municipality. The comprehensive plan is a blueprint for housing, transportation, community facilities, utilities, and land use. It examines how the past led to the present and charts the community's future path. The Pennsylvania Municipalities Planning Code (MPC Act 247 of 1968, as reauthorized and amended) requires counties to prepare and maintain

a county comprehensive plan. In addition, the MPC requires counties to update the comprehensive plan every ten years.

With regard to hazard mitigation planning, Section 301.a(2) of the Municipality Planning Code requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the plan gives consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services and recommends considering storm drainage and floodplain management.

Article III of the MPC enables municipalities to prepare a comprehensive plan; however, development of a comprehensive plan is voluntary. There are three regional comprehensive plans, written in 2015 and 2005, which cover thirteen of the twenty municipalities in Monroe County. The remaining seven municipalities fall under the Monroe County Comprehensive Plan, written in 2014, titled "The Challenge Continues…".

Table 94 - Monroe County and Monroe Regional Comprehensive Plans

Monroe County and Monroe Regional Comprehensive Plans		
Plan Name	**Date Adopted**	**Municipalities**
Monroe County Comprehensive Plan, The Challenge Continues	2014	All Monroe County Municipalities
HSPS Regional Plan	Currently in final draft format	Hamilton Township, Stroud Township, Pocono Township and Stroudsburg Borough
CJERP Regional Plan	2015	Chestnuthill Township, Jackson Township, Eldred Township, Ross Township and Polk Township
Top of the Mountain Regional Plan	2006	Coolbaugh Township, Mt. Pocono Borough, Tobyhanna Township, Tunkhannock Township

Capital Improvements Plan

The capital improvements plan is a multi-year policy guide that identifies needed capital projects and is used to coordinate the financing and timing of public improvements. Capital improvements relate to streets, stormwater systems, water distribution, sewage treatment and other major public facilities. A capital improvements plan should be prepared by the respective county's planning department and should include a capital budget. This budget identifies the

highest priority projects recommended for funding in the next annual budget. The capital improvements plan is dynamic and can be tailored to specific circumstances. Monroe County does not have any capital improvement plans in place.

Participation in the National Flood Insurance Program (NFIP)

Floodplain management is the operation of programs or activities that may consist of both corrective and preventive measures for reducing flood damage, including but not limited to such things as emergency preparedness plans, flood control works and flood plain management regulations. The Pennsylvania Floodplain Management Act (Act 166) requires every municipality identified by the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program (NFIP) and permits all municipalities to adopt floodplain management regulations. It is in the interest of all property owners in the floodplain to keep development and land usage within the scope of the floodplain regulations for their community. This helps keep insurance rates low and makes sure that the risk of flood damage is not increased by property development.

The Pennsylvania DCED provides communities, based on their CFR, Title 44, Section 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP along with the Pennsylvania Flood Plain Management Act (Act 166). These suggested or model ordinances contain provisions that are more restrictive than state and federal requirements. Suggested provisions include, but are not limited to:

1. Prohibiting manufactured homes in the floodway.
2. Prohibiting manufactured homes within the area measured 50 feet landward from the top-of bank of any watercourse within a special flood hazard area.
3. Special requirements for recreational vehicles within the special flood hazard area.
4. Special requirement for accessory structures.
5. Prohibiting new construction and development within the area measured 50 feet landward from the top-of bank of any watercourse within a special flood hazard area.
6. Providing the county conservation district an opportunity to review and comment on all applications and plans for any proposed construction or development in any identified floodplain area.

Act 166 mandates municipal participation in and compliance with the NFIP. It also establishes higher regulatory standards for new or substantially improved structures which are used for the production or storage of dangerous materials (as defined by Act 166) by prohibiting them in the floodway. Additionally, Act 166 establishes the requirement that a special permit be obtained prior to any construction or expansion of any manufactured home park, hospital, nursing home, jail and prison if said structure is located within a special flood hazard area.

The NFIP's Community Rating System (CRS) provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Under the CRS, communities receive credit for more restrictive regulations; acquisition, relocation, or flood-proofing of flood-prone buildings; preservation of open space; and other measures that reduce flood damages or protect the natural resources and functions of floodplains.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the Community Rating System in the NFIP. The section also expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS and communities now receive credit toward premium reductions for activities that contribute to them.

Under the Community Rating System, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet a minimum of three of the following CRS goals:

1. Reduce flood losses.
2. Protect public health and safety.
3. Reduce damage to property.
4. Prevent increases in flood damage from new construction.
5. Reduce the risk of erosion damage.
6. Protect natural and beneficial floodplain functions.
7. Facilitate accurate insurance rating.
8. Promote the awareness of flood insurance.

There are ten Community Rating System classes. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. CRS premium discounts on flood insurance range from 5% for Class 9 communities up to 45% for Class 1 communities. The CRS recognizes eighteen credible activities, organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction and Flood Preparedness.

FEMA Region III makes available to communities, an ordinance review checklist which lists required provisions for floodplain management ordinances. This checklist helps communities develop an effective floodplain management ordinance that meets federal requirements for participation in the NFIP. The Pennsylvania Department of Community and Economic Development (DCED) provides communities, based on their 44 CFR 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum

requirements of the NFIP and the Pennsylvania Flood Plain Management Act (Act 166). Act 166 mandates municipal participation in and compliance with the NFIP. It also establishes higher regulatory standards for hazardous materials and high-risk land uses. As new Digital Flood Insurance Rate Maps (DFIRMs) are published, the Pennsylvania State NFIP Coordinator at DCED works with communities to ensure the timely and successful adoption of an updated floodplain management ordinance by reviewing and providing feedback on existing and draft ordinances.

All twenty municipalities that reside in Monroe County have floodplain regulations in place that meet requirements set forth by the NFIP. Currently, no municipalities have completed or started to complete the CRS program. Additional research will be conducted on the CRS program. For the 2021 Monroe County HMP Update, a mitigation objective and two mitigation actions were added or updated for the 2021 mitigation strategy. The following outlines mitigation items:

- Objective 1.2: Recommend that flood insurance policies remain affordable through government programs, especially through the NFIP's CRS.
- Action 1.2.1: Encourage participation in the NFIP-CRS program through outreach and education to municipal.
- Action 1.2.2: Develop CRS information sheet based on the CRS pointing system to assist municipalities in obtaining CRS certification.

In an effort to spread awareness as well as capture participation levels, all municipalities were instructed to complete an NFIP survey provided by the Federal Emergency Management Agency. In total, seventeen municipalities submitted an NFIP survey. These surveys can be found in Appendix C of this plan.

5.2.2. Administrative and Technical Capability

There are four boroughs and sixteen townships within Monroe County. Each of these municipalities conducts its daily operations and provides various community services according to local needs and limitations. Some of these municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide services such as police protection, fire and emergency response, infrastructure maintenance and water supply management. Others choose to operate on their own. Municipalities vary in staff size, resource availability, fiscal status, service provision, constituent population, overall size and vulnerability to the profiled hazards.

County Planning Commission

In Pennsylvania, planning responsibilities traditionally have been delegated to each county and local municipality through the Municipalities Planning Code (MPC). A planning agency acts as an advisor to the governing body on matters of community growth and development. A

governing body may appoint individuals to serve as legal or engineering advisors to the planning agency. In addition to the duties and responsibilities authorized by Article II of the MPC, a governing body may, by ordinance, delegate approval authority to a planning agency for subdivision and land development applications. A governing body has considerable flexibility, not only as to which powers and duties are assigned to a planning agency, but also as to what form an agency will possess. A governing body can create a planning commission, a planning department, or both. The Monroe County Planning Commission assists all municipalities in the county as needed. The county employs a county planner on an annual basis.

Municipal Engineer

A municipal engineer performs duties as directed in the areas of construction, reconstruction, maintenance and repair of streets, roads, pavements, sanitary sewers, bridges, culverts, and other engineering work. The municipal engineer prepares plans, specifications and estimates of the work undertaken by the township. Two municipalities in Monroe County employ a municipal engineer: Tobyhanna Township and Stroud Township.

Personnel Skilled in GIS or FEMA HAZUS Software

A geographic information system (GIS) is an integrated, computer-based system designed to capture, store, edit, analyze, and display geographic information. Some examples of uses for GIS technology in local government are land records management, land use planning, infrastructure management and natural resources planning. A GIS automates existing operations such as map production and maintenance, saving a great deal of time and money. The GIS also includes information about map features such as the capacity of a municipal water supply or the acres of public land. GIS data is managed, maintained and developed by the Monroe County Planning Commission. There are no members of the Monroe County GIS Department that have completed Basic HAZUS-MH.

Emergency Management Coordinator

Emergency management is a comprehensive, integrated program of mitigation, preparedness, response, and recovery for emergencies/disasters of any kind. No public or private entity is immune to disasters and no single segment of society can meet the complex needs of a major emergency or disaster on its own.

A municipal emergency management coordinator is responsible for emergency management – preparedness, response, recovery, and mitigation within his/her respective authority having jurisdiction (AHJ). The responsibilities of the emergency management coordinator are outlined in PA Title 35 §7503:

- Prepare and maintain a current disaster emergency management plan.
- Establish, equip, and staff an emergency operations center.

- Provide individuals and organizations training programs.
- Organize and coordinate all locally available manpower, materials, supplies, equipment, and services necessary for disaster emergency readiness, response, and recovery.
- Adopt and implement precautionary measures to mitigate the anticipated effects of a disaster.
- Cooperate and coordinate with any public and private agency or entity.
- Provide prompt information regarding local disaster emergencies to appropriate Commonwealth and local officials or agencies and the general public.
- Participate in all tests, drills and exercises, including remedial drills and exercises, scheduled by the agency or by the federal government.

Title 35 requires Monroe County and its municipalities to have an emergency management coordinator.

The Monroe County Office of Emergency Management coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazard events have on their community.

The Emergency Management Services Code (PA Title 35) requires that all municipalities in the Commonwealth have a local emergency operations plan (EOP) which is updated every two years. All twenty municipalities have adopted the county EOP. The notification and resource section of the plan was developed individually by each municipality.

Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to mitigate hazard events. The adoption of hazard mitigation measures may be seen as an impediment to growth and economic development. In many cases, mitigation may not generate interest among local officials when compared with competing priorities. Therefore, the local political climate must be considered when designing mitigation strategies, as it could be the most difficult hurdle to overcome in accomplishing the adoption or implementation of specific actions.

The capability assessment survey was used to capture information on each jurisdiction's political capability. Survey respondents were asked to identify examples of political capability, such as guiding development away from hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e. building codes, floodplain management ordinances, etc.). These examples were used to guide respondents in scoring their community on a scale of

"unwilling" (0) to "very willing" (5) to adopt policies and programs that reduce hazard vulnerabilities. Of the municipalities that responded, none of the municipalities completed this section with a numerical response. *Table 94 – Monroe County Community Political Capability* summarizes the results of political capability.

Table 95 - Monroe County Community Political Capability

Monroe County Community Political Capability						
Municipality Name	**Capability Ranking**					
	0	**1**	**2**	**3**	**4**	**5**
Barrett Township				X		
Chestnuthill Township					X	
Coolbaugh Township				X		
Delaware Water Gap Borough	Not completed by municipality					
East Stroudsburg Borough					X	
Eldred Township						X
Hamilton Township					X	
Jackson Township				X		
Middle Smithfield Township						X
Mount Pocono Borough					X	
Paradise Township						X
Pocono Township				X		
Municipality Name	**Capability Ranking**					
	0	**1**	**2**	**3**	**4**	**5**
Polk Township						X
Price Township	Not completed by municipality					
Ross Township						
Smithfield Township				X		
Stroud Township				X		
Stroudsburg Borough	Not completed by municipality					
Tobyhanna Township				X		
Tunkhanock Township						X

Self-Assessment

In addition to the inventory and analysis of specific local capabilities, the capability assessment survey required each local jurisdiction to conduct its own self-assessment of its capability to

effectively implement hazard mitigation activities. As part of this process, county and municipal officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either "L = limited" "M = moderate" or "H = high." *Table 95 – Capability Self-Assessment Matrix* summarizes the results of the self-assessment survey. Nineteen municipalities returned this section of the assessment completed.

Table 96 - Capability Self-Assessment Matrix

Monroe County Capability Self-Assessment Matrix				
Municipality Name	**Capability Category**			
	Planning and Regulatory Capability	**Administrative and Technical Capability**	**Fiscal Capability**	**Community Political Capability**
Barrett Township	L	L	L	L
Chestnuthill Township	H	H	H	H
Coolbaugh Township	M	M	L	M
Delaware Water Gap Borough	M	M	L	H
East Stroudsburg Borough	M	M	L	M
Eldred Township	M	M	L	M
Hamilton Township	M	H	M	M
Jackson Township	L	M	L	L
Middle Smithfield Township	M	M	M	M
Mount Pocono Borough	M	M	L	M
Paradise Township	H	M	M	H
Pocono Township	L	L	L	M
Polk Township	M	M	L	M
Price Township	L	L	L	L
Ross Township	H	H	H	H
Smithfield Township	L	L	L	L
Stroud Township	H	M	M	H
Stroudsburg Borough	H	H	M	M
Tobyhanna Township	H	M	M	H
Tunkhanock Township	M	M	L	M

Existing Limitations

Funding has been identified as the largest limitation for a municipality to complete mitigation activities. The acquisition of grants is the best way to augment this process for the municipalities. The county and municipalities representatives will need to rely on regional, state, and federal partnerships for future financial assistance. Development of intra-county regional partnerships and intra-municipality regional partnerships will bolster this process.

5.2.3. Financial Capability

Fiscal capability is significant to the implementation of hazard mitigation activities. Every jurisdiction must operate within the constraints of limited financial resources. The following information pertains to various financial assistance programs relevant to hazard mitigation.

State and Federal Grants

During the 1960s and 1970s, state and federal grants-in-aid were available to finance a large number of municipal programs, including streets, water and sewer facilities, airports, parks, and playgrounds. During the early 1980s, there was a significant change in federal policy, based on rising deficits and a political philosophy that encouraged states and local governments to raise their own revenues for capital programs. The result has been a growing interest in "creative financing".

Capital Improvement Financing

Because most capital investments involve the outlay of substantial funds, local governments can seldom pay for these facilities through annual appropriations in the annual operating budget. Therefore, numerous techniques have evolved to enable local government to pay for capital improvements over a time period exceeding one year. Public finance literature and state laws governing local government finance classify techniques that are used to finance capital improvements. The techniques include: revenue bonds; lease-purchase, authorities and special district; current revenue (pay-as-you-go); reserve funds; and tax increment financing. Most municipalities have very limited local tax funds for capital projects. Grants and other funding is always a priority.

Indebtedness through General Obligation Bonds

Some projects may be financed with general obligation bonds. With this method, the jurisdiction's taxing power is pledged to pay interest and principal to retire debt. General obligation bonds can be sold to finance permanent types of improvements, such as schools, municipal buildings, parks, and recreation facilities. Voter approval may be required.

Municipal Authorities

Municipal authorities are most often used when major capital investments are required. In addition to sewage treatment, municipal authorities have been formed for water supply, airports, bus transit systems, swimming pools and other purposes. Joint authorities have the power to receive grants, borrow money and operate revenue generating programs. Municipal authorities are authorized to sell bonds, acquire property, sign contracts and take similar actions. Authorities are governed by authority board members, who are appointed by the elected officials of the member municipalities.

Sewer Authorities

Sewer authorities include multi-purpose authorities with sewer projects. They sell bonds to finance acquisition of existing systems or for construction, extension, or system improvement. Sewer authority operating revenues originate from user fees. The fee frequently is based on the amount of water consumed and payment is enforced by the ability to terminate service or by the imposition of liens against real estate. In areas with no public water supply, flat rate charges are calculated on average use per dwelling unit.

Water Authorities

Water authorities are multi-purpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to the municipality is among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage. The cost of construction or extending water supply lines can be funded by special assessments against abutting property owners. Tapping fees also help fund water system capital costs. Water utilities are also directly operated by municipal governments and by privately owned public utilities regulated by the Pennsylvania Public Utility Commission. The Pennsylvania Department of Environmental Protection has a program to assist with consolidating small water systems to make system upgrades more cost effective.

Circuit Riding Program (Engineer)

The Circuit Riding Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join together to accomplish a common goal. The circuit rider is a municipal engineer who serves several small municipalities simultaneously. These are municipalities that may be too small to hire a professional engineer for their own operations yet need the skills and expertise the engineer offers. Municipalities can jointly obtain what no one municipality could obtain on its own.

5.2.4. Education and Outreach

Monroe County conducts an education and outreach program. The Monroe County Office of Emergency Management conducts public outreach at public events to update the citizens and visitors of the county on natural and human-caused hazards. The county conservation district also conducts outreach on various activities and projects in the county. Many of these projects are related to or directly impact hazard mitigation projects.

Educational activities that directly impact hazard mitigation in Monroe County predominantly revolve around the first responders. Providing fire, medical, and search and rescue training and education enhances the response and recovery capabilities of response agencies in the county. Additional training is always a goal within Monroe County.

Education and outreach on the NFIP are necessary. With new regulations in floodplain management, updated digital flood insurance rate maps and new rates for insurance policies, education, and outreach on the NFIP would assist the program. The Monroe County Local Planning Team will identify actions necessary to complete this.

5.2.5. Plan Integration

The Monroe 2030 County Comprehensive Plan, December 2014, was utilized for various sections of the 2021 Monroe County HMP update. The Monroe County Comprehensive Plan provided useful information on historical context, population and housing, land use, economic development, transportation, facilities, and utilities. The existing land use plan section was utilized when developing section 2.4 of the community profile which provided valuable information on land use trends in Monroe County. The population projections and socioeconomic projections found on page thirteen of the comprehensive plan was also used in section 2.3 population and demographics and provided information on housing, education, and general economics.

Section II – recommendations (found on page twenty-three), consists of twelve goals which include the following topics: land use, housing, transportation, community facilities, water supply, solid waste and storm/wastewater, management and utilities, energy conservation, agricultural land preservation, open space recreation, historic preservation, and a food system plan. Each category includes topic summaries and implementation information. Section III – policies (found on page seventy-five), includes six additional topics: economic development, housing, energy, roadscape, advocacy, and arts and culture. Each goal from this plan provided numerous objectives which were used during the development of the mitigation action plan found in section 6.4. The following are some of the goals and actions from the 2014 comprehensive plan, followed by the 2021 HMP mitigation actions that were developed or supported by the goals and actions from the 2014 comprehensive plan:

- An identified objective in the county comprehensive plan mentions the promotion of stormwater management. The 2021 HMP local planning team developed mitigation action 1.1.1 which discusses ongoing stormwater plan maintenance and outreach. Additionally, actions 2.2.3 and 2.2.4 discuss the maintenance and management of infrastructure to prevent future damage, and mitigation action 2.2.2 outlines debris removal to reduce flood vulnerability. Mitigation goal 1, and objectives 1.1, 1.2, and 1.3, reenforce commitment to buttressing stormwater and flood preparedness.

- An identified objective in the county comprehensive plan includes roadway maintenance and safety. The 2021 HMP local planning team developed mitigation actions 5.1.1 and 5.1.2 which outlines roadway and bridge repair (or replacement) to alleviate transportation accidents or structural failure. Further, action 6.1.1 calls for the submission of known potholes to PennDOT. Actions 6.2.1 and 6.2.3 pertain to the perpetuation of a transportation planning work group to conduct planning for item transportation related to road closures.

- An identified objective in the county comprehensive plan is to improve telecommunication infrastructure. Goal 2.7 of the 2021 HMP update establishes support and enhancement of broadband and cellular services to unserved areas.

Although specific portions of the comprehensive plan outlined projects, actions or specific planning items that would support hazard mitigation, the information will be more comprehensive with the integration of new hazard mitigation principles and data from the 2021 Monroe County HMP update. During discussion with county planning personnel as part of this hazard mitigation plan update, discussions about the importance of hazard mitigation integration during the next comprehensive plan update was expressed. Specifically, the risk assessment section and mitigation strategy section hold vital information that requires integration into the next plan update. Identification of hazard areas, vulnerable structures and developments and future risk is critical in the determination of and management of economic growth and development to areas in the county. Numerous mitigation opportunity forms have been received during the planning period and would provide beneficial information for the next comprehensive plan update as well.

The Monroe County Opiate Task Force Three-Year Strategic Plan outlines goals and objectives to prevent and mitigate the effects of substance abuse. The plan provides information on substance abuse and overdose rates in the community.

- An identified goal of the Three-Year Strategic Plan involves substance abuse education. Specifically, the first and fourth goals call for community-wide education on the signs and symptoms of abuse, as well as available treatment options. Likewise, mitigation action 3.1.4 underscores commitment to intracommunity outreach and substance abuse

education. Mitigation action 3.3.3 also outlines the continued promotion of the Opioid Task Force to increase public awareness.

Monroe County Emergency Operations Plan

The Pennsylvania Emergency Management Services Code, 35 PA C.S. Sections 7701-7707, as amended, requires each county and municipality to prepare, maintain and keep current an Emergency Operations Plan (EOP). Monroe County Office of Emergency Management is responsible for preparing and maintaining the county's EOP, which applies to both the county and municipal emergency management operations and procedures.

The EOP is reviewed at least annually. Whenever portions of the plan are implemented in an emergency event or training exercise, a review is performed, and changes are made where necessary. These changes are then distributed to the county's municipalities.

The complete risk assessment section, mitigation actions and mitigation project opportunities identified in the Monroe County Hazard Mitigation Plan will assist with decreasing hazard specific risk and vulnerability. Understanding the risks and vulnerability in the county and municipalities will allow for emergency management and other response agencies to better direct planning, response, and recovery aspects.

Monroe County Office of Emergency Management will consider the Monroe County Hazard Mitigation Plan during its annual review of the county EOP. Recommended changes to the HMP will then be coordinated with the hazard mitigation local planning team.

Plan Interrelationships

Ensuring consistency between these planning mechanisms is critical. In fact, Section 301 (4.1) of the Pennsylvania Municipalities Planning Code requires that comprehensive plans include a discussion of the interrelationships among their various plan components, "which may include an estimate of the environmental, energy conservation, fiscal, economic development and social consequences on the environment."

To that end, Monroe County and its municipalities must ensure that the components of the hazard mitigation plan are integrated into existing community planning mechanisms and are generally consistent with goals, policies, and recommended actions. Monroe County and the hazard mitigation planning team will utilize the existing maintenance schedule of each plan to incorporate the goals, policies and recommended actions as each plan is updated.

6. Mitigation Strategy

6.1. Update Process Summary

Mitigation goals are general guidelines that explain what the county wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date. There were six goals and seventeen objectives identified in the 2016 hazard mitigation plan. The 2021 Monroe County Hazard Mitigation Plan Update has four goals and thirteen objectives. Objectives have been added and arranged in order to associate them with the most appropriate goal. These changes are noted in *Table 96 – 2016 Mitigation Goals and Objectives Review*. These reviews are based on the five-year hazard mitigation plan review worksheet, which includes a survey on existing goals and objectives completed by the local planning team. Municipal officials then provided feedback on the changes to the goals and objectives via a mitigation strategy update meeting. Copies of these meetings and all documentation associated with the meetings are located in Appendix C.

Actions provide more detailed descriptions of specific work tasks to help the county and its municipalities achieve prescribed goals and objectives. There were forty actions identified in the 2016 mitigation strategy. A review of the 2016 mitigation actions was completed by the local planning team. The results of this review are identified in *Table 97 – 2016 Mitigation Actions Review.* Actions were evaluated by the local planning team with the intent of carrying over any actions that were not started or continuous for the next five years.

Table 97 - 2016 Mitigation Goals and Objectives Review

2016 Mitigation Goals and Objectives Review		
GOAL Objective	**Description**	**Review**
GOAL 1	Reduce potential injury, death, and damage to existing community assets due to natural hazards, especially flooding.	The LPT decided that this goal should remain in the 2021 plan update.
Objective 1.1	Continue to use stormwater management planning as a means to reduce flood losses.	The LPT decided that this objective should remain in the 2021 plan update.

GOAL Objective	Description	Review
Objective 1.2	Recommend that flood insurance policies remain affordable through government programs, especially through the NFIP's CRS.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 1.3	Ensure adequate and consistent enforcement of ordinances and codes within and between jurisdictions.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 1.4	Assess and implement historic preservation data to increase hazard mitigation planning.	The LPT decided that this objective should be changed to an action.
GOAL 2	Reduce the potential impact and losses stemming from natural and human made disasters on public and private property.	The LPT decided this goal should change to human-caused instead of human-made.
Objective 2.1	Reduce wildfire potential through planning and outreach.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 2.2	Ensure that existing streams and drainage systems are located, adequate and functioning properly, when funding and technical assistance is available.	The LPT decided that this objective should be changed to: "Ensure that existing streams and drainage systems are engineered and maintained properly when funding and technical assistance is available."
Objective 2.3	Reduce the number of repetitive loss and severe repetitive loss properties in the County.	The LPT decided this objective should be updated to: "Complete actions and projects to acquire, elevate, demolish, or demolish/reconstruct repetitive loss properties."

GOAL Objective	Description	Review
Objective 2.4	Develop and maintain GIS data that supports hazard mitigation planning.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 2.5	Encourage and facilitate the development of continuity planning to reduce impact of natural and man-made hazards.	The LPT decided this objective should be updated to: "Encourage and facilitate the development of continuity planning to reduce the impact of natural and human-caused hazards."
GOAL 3	Increase public education awareness regarding natural and man-made hazard risk and vulnerability, preparedness, and mitigation.	The LPT decided this goal should be changed from man-made to human-caused. "Increase public education awareness regarding natural and human-caused hazards, risks, vulnerabilities, preparedness, and mitigation."
Objective 3.1	Support public education programs for business, household and individual mitigation, safety measures and preparedness.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 3.2	Advise the public on small-scale preservation and conservation measures.	The LPT decided that this objective should remain in the 2021 plan update.
GOAL 4	Improve emergency preparedness, warning and response procedures and capabilities.	The LPT decided that this goal should remain in the 2021 plan update.

GOAL Objective	Description	Review
Objective 4.1	Maintain and upgrade emergency services equipment.	"Maintain, upgrade, and provide necessary training on emergency services equipment."
Objective 4.2	Provide residents with adequate warning of potential floods and other weather related events.	The LPT discussed including an action related to CodeRed, Ipaws…etc.
GOAL 5	Reduce or redirect the impact of natural disaster away from at-risk environmental and population areas.	The LPT decided this goal should be updated to: "Reduce or redirect the impact of all hazards away from at-risk, environmental, and urbanized areas."
Objective 5.1	Research possible structural mitigation projects to redirect or reduce the impact of disasters.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 5.2	Encourage and facilitate the development of comprehensive plan, zoning, land use, and, most importantly, floodplain management ordinances to appropriately direct development away from high-hazard areas.	The LPT decided that this objective should be updated to: "Encourage and facilitate the development of comprehensive plans, zoning and land use ordinances, and, most importantly, floodplain management ordinances to appropriately direct development away from high-hazard areas."

GOAL Objective	Description	Review
GOAL 6	Reduce the potential impact and losses stemming from technological disasters on public and private property.	The LPT decided that this goal should remain in the 2021 plan update.
Objective 6.1	Provide education programs to public and private property owners and business owners.	The LPT decided that this objective should remain in the 2021 plan update.
Objective 6.2	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.	The LPT decided that this objective should remain in the 2021 plan update.

Table 98 - 2016 Mitigation Actions Review

Monroe County Mitigation Actions Review Worksheet						
Existing Mitigation Actions *(2016 HMP)*	***Status***					***Review Comments***
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 1.1.1 – Continue regular updates to the Stormwater Management Plan and Ordinance for the Brodhead and McMichaels Creeks, which includes an updated floodplain ordinance and conductoutreach.		X				Monroe County is currently in the process of updating the Stormwater Management Plan. The LPT decided this action should be included in the 2021 HMP update.
Action 1.2.1 - Encourage participation in the NFIP-CRS program through outreach and education to municipal officials.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 1.2.2 - Develop CRS information sheet based on the CRS pointing system to assist municipalities in obtaining CRS Certification.	X					The LPT decided this action should be included in the 2021 HMP update.
Action 1.3.1 - Enforce the municipal floodplain ordinances to reduce the impact of flooding.			X			The LPT decided to reword this action to: "Enforce and update the municipal floodplain ordinances to reduce the impact of flooding."
Action 2.1.1 - Develop work group to investigate the initiation of a Firewise program.					X	The LPT decided this action should be combined with 2.1.4 below.
Action 2.1.2 - Encourage wildfire-prone municipalities to implement outdoor burning bans, providing ordinance-writing assistance where necessary.		X				The LPT decided this action should be included in the 2021 HMP update.
Action 2.1.3 - Conduct homeowner and business owner outreach to the public on the importance of clearing brush and grass away from buildings, making them less susceptible to wildfires.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 2.1.4 - Complete the activities to secure Firewise designation.					X	The LPT decided this action should be combined with 2.1.1 above.
Action 2.2.1 - Correct drainage problems as identified in Brodhead/McMichaels and Tobyhanna Creek Watershed Act 167 Plans.		X				The LPT decided to change this so it reads: "Address drainage…" The LPT added the following actions for the 2021 update: "Conduct regular maintenance on stormwater management structures in compliance with MS4 guidelines. Encourage regular maintenance on stormwater management structures and replace as needed." Encourage non MS4 communities to perform regular maintenance on stormwater management structures and replace as needed.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 2.2.2 – Clean up brush and debris in waterways in identified locations and jurisdictions to alleviate flooding.		X				The LPT decided to rephrase this action so it reads "Remove brush…"
Action 2.2.3 - Develop a workgroup to discuss and investigate the permitting process for debris removal in at-risk waterways.			X			The LPT decided to rephrase this action to: "Develop a workgroup with the Conservation District to discuss…"
Action 2.3.1 - Continue to target and prioritize at-risk structures for acquisition, relocation, and elevation countywide, completing Hazard Mitigation OpportunityForms when applicable, and meet with homeowners on the benefits of mitigation opportunity.			X			The LPT decided to rephrase this action to: "Continue to target flood prone properties for acquisition, relocation, elevation and demolition/reconstruction countywide, completing Hazard Mitigation Opportunity Forms when applicable, and meet…"

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 2.3.2 - Identify the lowest floor elevation of the most vulnerable structures to flooding, especially historical, repetitive loss and severe repetitive loss properties.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 2.4.1 - Develop additional and maintain current GIS layers for critical facilities and infrastructure.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 2.4.2 - Develop additional GIS layers for public utility services.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 2.5.1 - Conduct emergency planning for transportation routes to reduce business interruption from transportation accidents.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 2.5.2 - Develop and implement an Emergency Action Plan for the East Stroudsburg/Stroudsburg Joint Flood Control Project.	X					The LPT decided this action should be included in the 2021 HMP update.
Action 2.5.3 - Complete the activities to secure "Storm Ready" designation.			X			Reword to: Encourage non-Storm Ready municipalities to obtain designation."
Action 2.5.4 - Continue the activities to maintain "Storm Ready" designation.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 2.5.5 - Establish a hazard mitigation workgroup that includes utility providers to investigate ways to decrease utility outages.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 3.1.1 - Conduct community outreach and public education materials for all hazards, including household safety, preparedness and personal mitigation measures, especially flooding and wildfire.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 3.1.2 - Continue environmental education center programs for school students.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 3.1.3 - Public outreach on the vulnerabilities and risk factors of drowning.			X			The LPT decided to reword this action to: "Continue to provide public outreach on drowning hazards."
Action 3.2.1 - Expand public education programs for homeowner conservation measures to deal with drought events.			X			The LPT decided to reword this action to: "Expand public education programs for homeowner conservation measures to address drought events."
Action 4.1.1 - Identify emergency response equipment and training that is needed by first responders for response to hazardous material incidents.			X			The LPT decided to rephrase this action to: "Identify emergency response equipment and training that is needed by first responders concerning hazardous material incidents."
Action 4.1.2 - Conduct primary road commodity flow study in Monroe County.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 4.1.3 - Conduct secondary road commodity flow study in Monroe County.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 4.1.4 - Identify emergency generator capabilities for critical facilities in Monroe County.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 4.1.5 - Install emergency generators at critical facilities and other essential facilities to enhance capabilities during utility outages.			X			East Stroudsburg University has added a generator enabling the Koehler Field House to be a mass shelter/surge hospital for Monroe County.
Action 4.2.1 - Integrate any municipal public notification systems with the Monroe County notification system to enhance dissemination of emergency information and public warning.		X				The LPT decided this action should be included in the 2021 HMP update.
Action 4.2.2 - Develop a county wide notification and early warning plan for vulnerable populations in Monroe County.			X			The LPT decided this action should be included in the 2021 HMP update.

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 5.1.1 - Maintain, repair, and/or replace roadway drainage systems at identified locations to alleviate flooding and prevent transportation incidents.			X			The LPT decided this action should be rephrased to: "Maintain, repair, and/or replace roadway drainage systems at identified locations to alleviate flooding/flash flooding and prevent transportation incidents.
Action 5.1.2 - Maintain and/or reconstructidentified bridges to prevent transportation accidents and improve the transportationnetwork.			X			The LPT decided this action should be included in the 2021 HMP update.
Action 5.2.1 – Enforce UCC and promote the establishment of best practices on implementation.			X			The LPT decided this action should be reworded to: "Encourage municipalities to enforce…"
Action 5.2.2 - Integrate the 2016 Monroe County hazard mitigation data and principals into local municipal planning efforts.			X			The LPT decided this action should be changed to reflect the year 2021.

Existing Mitigation Actions *(2016 HMP)*	***Status***					***Review Comments***
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 5.2.3 - Integrate the 2016 MonroeCounty hazard mitigation plan with the East Stroudsburg University hazard mitigation plan.				X		The LPT decided this action should be changed to reflect the year 2021.
Action 6.1.1 - Develop a list of problem potholes within the county and submit to PennDOT and appropriate municipalities.			X			The LPT decided this action should be reworded to: "Continue to address a list of problem potholes within the county and submit to PennDOT and appropriate municipalities."
Action 6.2.1 - Conduct outreach to privateowners of high-hazard dams on the importance of dam safety planning and on mitigation opportunities for dam failure hazards.	X					The LPT decided this action should be reworded to: "Continue to conduct outreach to private…" The LPT decided this action should move to 7.1
Action 6.2.2 - Develop a Route 611 transportation planning work group to conduct planning for transportation items related to major interstate shutdowns.		X				The LPT decided this action should be reworded to: "Maintain Route 611 transportation…"

Existing Mitigation Actions *(2016 HMP)*	*Status*					*Review Comments*
	No Progress/ Unknown	**In Progress/Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
Action 6.2.3 - Develop a transportation planning work group to conduct planning for transportation items related to majorhighway shutdowns.		X				The LPT decided this action should be reworded to: "Maintain a transportation planning work group…"

6.2. Mitigation Goals and Objectives

Based on results of the goals and objectives evaluation exercise and input from the local planning team, a list of four goals and thirteen corresponding objectives was developed. *Table 98 – 2021 Goals and Objectives* details the mitigation goals and objectives established for the 2021 Monroe County Hazard Mitigation Plan.

Table 99 - 2021 Goals and Objectives

2021 Monroe County Mitigation Goals and Objectives	
Goal Objective	**Description**
Goal 1	**Reduce potential injury, death, and damage to existing community assets due to natural hazards, especially flooding.**
Objective 1.1	Continue to use stormwater management planning as a means to reduce flood losses.
Objective 1.2	Recommend that flood insurance policies remain affordable through government programs, especially through the NFIP's CRS.
Objective 1.3	Ensure adequate and consistent enforcement of ordinances and codes within and between jurisdictions.
Goal 2	**Reduce the potential impact and losses stemming from natural and human-caused disasters on public and private property.**

Goal Objective	Description
Objective 2.1	Reduce wildfire potential through planning and outreach.
Objective 2.2	Ensure that existing streams and drainage systems are engineered and maintained properly when funding and technical assistance is available.
Objective 2.3	Complete actions and projects to acquire, elevate, demolish, or demolish/reconstruct repetitive loss properties.
Objective 2.4	Develop and maintain GIS data that supports hazard mitigation planning.
Objective 2.5	Encourage and facilitate the development of continuity planning to reduce the impact of natural and human-caused hazards.
Objective 2.6	Support and enhance broadband and cellular services to unserved areas.
Objective 2.7	Provide education programs to public and private property owners and business owners.
Objective 2.8	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.
Goal 3	**Increase public education awareness regarding natural and human-caused hazards, risks, vulnerabilities, preparedness, and mitigation.**
Objective 3.1	Support public education programs for business, household and individual mitigation, safety measures and preparedness.
Objective 3.2	Advise the public on small-scale preservation and conservation measures.
Objective 3.3	Collaborate with partnering agencies to promote awareness of natural and human-caused hazards.
Goal 4	**Improve emergency preparedness, warning and response procedures and capabilities.**
Objective 4.1	Maintain, upgrade, and provide necessary training on emergency services equipment.
Objective 4.2	Provide residents with adequate warning of potential floods and other weather-related events.
Objective 4.3	Ensure adequacy and maintain plans, equipment, and technology.
Goal 5	**Reduce or redirect the impact of all hazards away from at-risk, environmental, and urbanized areas.**
Objective 5.1	Research possible structural mitigation projects to redirect or reduce the impact of disasters.
Objective 5.2	Encourage and facilitate the development of comprehensive plans, zoning and land use ordinances, and, most importantly, floodplain management ordinances to appropriately direct development away from high-hazard areas.

Goal Objective	Description
Objective 5.3	Research and identify funding sources to decrease the impact of all-hazards in Monroe County.
Goal 6	**Reduce the potential impact and losses stemming from technological disasters on public and private property.**
Objective 6.1	Provide education programs to public and private property owners and business owners.
Objective 6.2	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.
Goal 7	**Participate in FEMA's High-Hazard Potential Dam Program (HHPD).**
Objective 7.1	Educate Monroe County municipalities, property owners, and businesses about FEMA's HHPD program.
Objective 7.2	Reduce long-term vulnerabilities from eligible high-hazard potential dams that pose an unacceptable risk to the public.

6.3. Identification and Analysis of Mitigation Techniques

This section includes an overview of alternative mitigation actions based on the goals and objectives identified in Section 6.2. There are four general mitigation strategy techniques to reducing hazard risks:

- Planning and regulations
- Structure and infrastructure
- Natural systems protection
- Education and awareness

Planning and Regulations: These actions include government authorities, policies or codes that influence the way land and buildings are developed and built. The following are some examples:

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- National Flood Insurance Program and Community Rating System
- Capital improvement programs
- Open space preservation
- Stormwater management regulations and master plans

The planning and regulations technique will protect and reduce the impact of specific hazards on new and existing buildings by improving building code standards and regulating new and renovation construction. The improved building codes will decrease the impact of risk hazards. Subdivision and land development enhancements will also augment this process. Ensuring that municipalities participate in the National Flood Insurance Program and encourage participation in the Community Rating System will decrease the impact as well.

Structure and infrastructure implementation: These actions involve modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. The following are examples:

- Acquisitions and elevations of structures in flood prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts
- Safe rooms

Structure and infrastructure implementation is a technique that removes or diverts the hazard from structures or protects the structure from a specific hazard. The new or renovated structures are therefore protected or have a reduced impact of hazards.

Natural Systems Protection: These are actions that minimize damage and losses and also preserve or restore the functions of natural systems. They include the following:

- Erosion and sediment control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Natural resource protection techniques allow for the natural resource to be used to protect or lessen the impact on new or renovated structures through the management of these resources. Utilization and implementation of the examples above will protect new and existing buildings and infrastructure.

Education and Awareness: These are actions to inform and educate citizens, elected officials and property owners about hazards and potential ways to mitigate them and may also include participation in national programs. Examples of these techniques include the following:

- Radio and television spots

- Websites with maps and information
- Real estate disclosure
- Provide information and training
- NFIP outreach
- StormReady
- Firewise Communities

The education and awareness technique will protect and reduce the impact of specific hazards on new and existing buildings through education of citizens and property owners on the impacts that specific hazards could have on new or renovated structures. This information will allow the owner to make appropriate changes or enhancements that will lessen or eliminate the impact of hazards.

Table 99 – Mitigation Strategy Technique Matrix provides a matrix identifying the mitigation techniques used for all low, moderate, and high-risk hazards in the county. The specific actions associated with these techniques are included in *Table 100 – 2021 Mitigation Action Plan*.

Table 100 - Mitigation Strategy Technique Matrix

Monroe County Mitigation Strategy Technique Matrix				
HAZARD	**MITIGATION TECHNIQUE**			
	Local Plans and Regulations	**Structural and Infrastructure**	**Natural Systems Protection**	**Education and Awareness**
Drought	X		X	X
Earthquakes	X	X		X
Extreme Temperatures	X			X
Flooding	X	X	X	X
Hurricane/Tropical Storm	X	X		X
Invasive Species	X		X	X
Pandemic and Infectious Disease	X		X	X
Tornado/Windstorm	X	X		X
Wildfires	X	X	X	X
Winter Storms/Nor'easter	X	X		X
Dam/Levee Failure	X		X	X
Disorientation	X	X		X
Drowning	X			X
Emergency Services Shortage	X			X

HAZARD	MITIGATION TECHNIQUE			
	Local Plans and Regulations	Structural and Infrastructure	Natural Systems Protection	Education and Awareness
Environmental Hazards/Hazardous Materials	X	X	X	X
Nuclear Incidents	X	X		X
Opioid/Substance Abuse	X			X
Terrorism/Cyber Terrorism	X			X
Transportation Accidents	X	X		X
Utility Interruptions	X	X		X

6.4. Mitigation Action Plan

The Monroe County Hazard Mitigation Local Planning Team (LPT) immediately began work on the mitigation strategy section of the 2021 hazard mitigation plan (HMP) update after the risk assessment section was completed. The LPT started this section by reviewing the 2016 HMP mitigation strategy section. A review of the previous goals, objectives, actions and project opportunities documented in the 2016 HMP was conducted. The next step the LPT completed was the brainstorming of possible new actions based on new identified risks. The LPT compiled all this information for presentations to the municipalities.

MCM Consulting Group, Inc. completed municipality meetings at various time periods via virtual platforms due to COVID-19. During all these meetings, an overview of mitigation strategy was presented, and the municipalities were informed that they needed to have at least one hazard-related mitigation action for their municipality. All municipalities were invited to attend these meetings. Municipalities that were not able to join conference calls were contacted individually.

The municipalities were notified of draft mitigation actions and encouraged to provide new mitigation actions that could be incorporated into the plan. Municipalities were provided copies of their previously submitted mitigation opportunity forms and asked to determine if the projects were still valid. Municipalities were solicited for new project opportunities as well. All agendas, sign in sheets and other support information from these meetings is included in Appendix C. Mitigation measures for the 2021 Monroe County HMP are listed in the mitigation action plan. *Table 100 – 2021 Mitigation Action Plan* is the 2021 Monroe County Mitigation Action Plan. This plan outlines mitigation actions and projects that comprise a strategy for Monroe County. The action plan includes actions, a benefit and cost prioritization, a schedule for implementation, any funding sources to complete the action, a responsible agency or department and an estimated

cost. All benefit and cost analysis were completed using the Pennsylvania Emergency Management Agency recommended analysis tool. The completed analysis is located in Appendix H. *Table 100 – 2021 Mitigation Action Plan* is a matrix that identifies the county and/or municipalities responsible for mitigation actions in the new mitigation action plan.

Table 101 - 2021 Mitigation Action Plan

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
1.1.1	Local Plans and Regulations	Continue regular updates to the Stormwater Management Plan and Ordinance for the Brodhead and McMichaels Creeks, which includes an updated floodplain ordinance and conduct outreach.	Flood, Flash Flood and Ice Jam Flooding		**X**		Continuous	Staff Time	Monroe County Conservation District

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
1.2.1	Education and Awareness	Encourage participation in the NFIP-CRS program through outreach and education to municipal officials	Flood, Flash Flood and Ice Jam Flooding	**X**			2021-2025	Staff Time	Monroe County OEM, Planning Commission and Conservation District
1.2.2	Education and Awareness	Develop CRS information sheet based on the CRS pointing system to assist municipalities in obtaining CRS certification	Flood, Flash Flood and Ice Jam Flooding	**X**			2021-2025	Staff Time	Monroe County Planning Commission
1.3.1	Local Plans and Regulations	Enforce and update the municipal floodplain ordinances to reduce the impact of flooding.	Flood, Flash Flood and Ice Jam Flooding		**X**		Continuous	Staff Time	Monroe County Municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.1.1	Education and Awareness	Develop work group to investigate the initiation of a Firewise program	Wildfire		**X**		2021-2025	FEMA and DCNR	Monroe County OEM and Municipalities
2.1.2	Local Plans and Regulations	Encourage wildfire-prone municipalities to implement outdoor burning bans, providing ordinance-writing assistance where necessary	Wildfire		**X**		2021-2025	Staff Time	Monroe County Planning Commission and OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.1.3	Education and Awareness	Conduct homeowner and business owner outreach to the public on the importance of clearing brush and grass away from buildings, making them less susceptible to wildfires	Wildfire		**X**		Continuous	FEMA and DCNR	Township Emergency Management Coordinators
2.2.1	Structural and Infrastructure	Address drainage problems as identified in Brodhead/McMichaels and Tobyhanna Creek Watershed Act 167 Plans	Flood, Flash Flood and Ice Jam		**X**		Continuous	FEMA and HMGP	Monroe County Conservation District

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.2.2	Natural Systems Protection	Remove brush and debris in waterways in identified locations and jurisdictions to alleviate flooding	Flood, Flash Flood and Ice Jam		**X**		Continuous	FEMA and HMGP	Township Supervisors
2.2.3	Local Plans and Regulations	Develop a workgroup with the Conservation District to discuss and investigate the permitting process for debris removal in at-risk waterways	Flood, Flash Flood and Ice Jam		**X**		2021-2025	Staff Time	Monroe County OEM and municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.2.4	Structural and Infrastructure	Conduct regular maintenance on stormwater management structures in compliance with MS4 guidelines. Encourage regular maintenance on stormwater management structures and replace as needed.	Flood, Flash Flood and Ice Jam		**X**		2021-2025	Staff Time	Monroe County municipalities
2.2.5	Structural and Infrastructure	Encourage non MS4 communities to perform regular maintenance on stormwater management structures and replace as needed.	Flood, Flash Flood and Ice Jam		**X**		2021-2025	Staff Time	Monroe County municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.3.1	Structural and Infrastructure	Continue to target flood prone properties for acquisition, relocation, elevation and demolition/reconstruction countywide, completing Hazard Mitigation Opportunity Forms when applicable, and meet with homeowners on the benefits of mitigation opportunity.	Flood, Flash Flood and Ice Jam		**X**		Continuous	HMGP FMA and BRIC	Monroe County OEM and municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.3.2	Structural and Infrastructure	Identify the lowest floor elevation of the most vulnerable structures to flooding, especially historical, repetitive loss and severe repetitive loss properties.	Flood, Flash Flood and Ice Jam		**X**		2021-2025	HMGP FMA and BRIC	Monroe County OEM and municipalities
2.4.1	Local Plans and Regulations	Develop additional and maintain current GIS layers for critical facilities and infrastructure	All Hazards		**X**		Continuous	Staff Time	Monroe County OEM and Planning Commission,

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.4.2	Local Plans and Regulations	Develop additional GIS layers for public utility services	Utility Interruptions, Flood, Windstorms, Tornado, Hurricane and Tropical Storms, Nor'easter, Wildfire, Transportation, HazMat Fixed facility, Dam Failure, Terrorism, Drought.		**X**		2021-2025	Staff Time	Monroe County OEM and GIS
2.5.1	Local Plans and Regulations	Conduct emergency planning for transportation routes to reduce business interruption from transportation accidents	Transportation Accidents and Hazardous Materials - Transportation		**X**		2021-2025	Staff Time	Township Supervisors

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.5.2	Local Plans and Regulations	Develop and implement an Emergency Action Plan for the East Stroudsburg /Stroudsburg Joint Flood Control Project	Flood, Flash Flood and Ice Jam		**X**		2021-2025	DEP and Boroughs	Stroudsburg and East Stroudsburg Boroughs
2.5.3	Education and Awareness	Encourage non-Storm Ready municipalities to obtain designation.	Flood, Flash Flood, Ice Jam, Winter Storm, Wildfire, Tornado, Windstorm, Hurricane, Tropical Storm, Nor'easter, Extreme Temperature	**X**			2021-2025	NOAA	Monroe County OEM and municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
2.5.4	Education and Awareness	Continue the activities to maintain "Storm Ready" designation	Flood, Flash Flood, Ice Jam, Winter Storm, Wildfire, Tornado, Windstorm, Hurricane, Tropical Storm, Nor'easter, Extreme Temperature	**X**			Continuous	NOAA and Local Taxes	Monroe County OEM and municipalities
2.5.5	Local Plans and Regulations	Establish a hazard mitigation workgroup that includes utility providers to investigate ways to decrease utility outages	Utility Interruptions	**X**			2021-2025	Staff Time	Monroe County OEM and municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
3.1.1	Education and Awareness	Conduct community outreach and public education materials for all hazards, including household safety, preparedness and personal mitigation measures, especially flooding and wildfire	All Hazards		**X**		Continuous	FEMA LEPC and HMGP	Monroe County OEM
3.1.2	Education and Awareness	Continue environmental education center programs for school students	All Hazards		**X**		Continuous	Staff Time	Monroe County Conservation District
3.1.3	Education and Awareness	Continue to provide public outreach on drowning hazards.	Drowning		**X**		2021-2025	Staff Time	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
3.1.4	Education and Awareness	Educate community groups, employers, persons at high-risk for an overdose, and persons in contact with high risk individuals about substance use disorder and treatment and recovery options.	Opioid/Substance Abuse	**X**			2021-2025	Staff Time	Monroe County Opiate Task Force
3.2.1	Education and Awareness	Expand public education programs for homeowner conservation measures to address drought events.	Drought		**X**		2021-2025	Staff Time	Monroe County Conservation District

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
3.3.1	Education and Awareness	Collaborate with Penn State Cooperative Extension, PA Department of Agriculture to promote and educate Monroe County residents about the impacts of invasive species.	Invasive Species	**X**			2021-2025	Staff Time	Monroe County Conservation District
3.3.2	Education and Awareness	Create a multi-disciplinary health task force to respond to future pandemic events.	Pandemic and Infectious Disease	**X**			2021-2025	Staff Time	Monroe County Commissioners

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
3.3.3	Education and Awareness	Continue to promote and raise awareness of the Monroe County Opioid Task Force to further enhance mitigation efforts.	Opioid/Substance Abuse	**X**			2021-2025	Staff Time	Monroe County OEM
4.1.1	Structural and Infrastructure	Identify emergency response equipment and training that is needed by first responders concerning hazardous material incidents.	Hazardous materials – Transportation and Fixed Facility	**X**			2021-2025	LEPC	Monroe County LEPC
4.1.2	Local Plans and Regulations	Conduct primary road commodity flow study in Monroe County.	Hazardous materials – Transportation		**X**		2021-2023	HMEP	Monroe County LEPC and ESU

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
4.1.3	Local Plans and Regulations	Conduct secondary road commodity flow study in Monroe County.	Hazardous materials – Transportation		**X**		2021-2023	HMEP	Monroe County LEPC and ESU
4.1.4	Structural and Infrastructure	Identify emergency generator capabilities for critical facilities in Monroe County.	Utility Interruptions		**X**		2021-2025	Local and FEMA	Monroe County OEM and ESU
4.1.5	Structural and Infrastructure	Install emergency generators at critical facilities and other essential facilities to enhance capabilities during utility outages	Utility Interruptions		**X**		2021-2025	Local and FEMA	Monroe County OEM
4.1.6	Local Plans and Regulations	Develop a multi-hazard drone emergency response team.	All Hazards		**X**		2021-2025	Local	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
4.1.7	Education and awareness	Promote the utilization of new technology such as the use of drones to support emergency responders.	Emergency Services Shortage/Disorientation/Hazardous Materials/Transportation Accidents	**X**			2021-2025	Local	Monroe County OEM
4.2.1	Local Plans and Regulations	Integrate any municipal public notification systems with the Monroe County notification system to enhance dissemination of emergency information and public warning	All Hazards		**X**		2021-2025	Staff Time	Monroe County OEM, Middle Smithfield Township, Chestnuthill Township, East Stroudsburg University

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
4.2.2	Local Plans and Regulations	Develop a county wide notification and early warning plans for vulnerable populations in Monroe County	Flooding, Flash Flooding, Ice Jam, Hazardous Materials-Transportation and Fixed Facility		**X**		2021-2025	Staff Time	Monroe County OEM
4.3.1	Education and awareness	Evaluate current network for cyber security threats.	Cyber Terrorism/Incidents		**X**		2021-2025	Local	Monroe County IT Department
4.3.2	Education and awareness	Provide education material to the public regarding the risks of cyber-crimes.	Cyber Terrorism/Incidents	**X**			2021-2025	Local	Monroe County OEM, Monroe County municipalities
4.3.3	Education and awareness	Continue to promote retention and recruitment efforts within municipal emergency services.	Emergency Services Shortage		**X**		2021-2025	Local	Monroe County OEM, Monroe County municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
4.3.4	Education and awareness	Coordinate outreach with education providers to enhance retention and recruitment of emergency services.	Emergency Services Shortage		**X**		2021-2025	Local	Monroe County OEM/ Monroe County School Districts
5.1.1	Structural and Infrastructure	Maintain, repair, and/or replace roadway drainage systems at identified locations to alleviate flooding/flash flooding and prevent transportation incidents.	Flood, Flash Flood, Ice Jam, Transportation Accidents and Hazardous Material - Transportation	**X**			Continuous	Local Taxes and HMGP	Monroe County Municipalities

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
5.1.2	Structural and Infrastructure	Maintain and/or reconstruct identified bridges to prevent transportation accidents and improve the transportation network	Flood, Flash Flood, Ice Jam Flooding, Transportation Accidents and Hazardous Material - Transportation	**X**			Continuous	PennDOT and Federal Highway Administration	Monroe County Municipalities
5.2.1	Local Plans and Regulations	Encourage municipalities to enforce UCC and promote the establishment of best practices on implementation.	All Hazards		**X**		Continuous	Staff Time	Monroe County Planning Commission
5.2.2	Local Plans and Regulations	Integrate the 2021 Monroe County hazard mitigation plan with other county plans.	All Hazards	**X**			2021-2025	Staff Time	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
5.3.1	Local Plans and Regulations	Explore funding opportunities for first responders through the Assistance to Firefighters Grant (AFG).	Emergency Services Shortage	**X**			2021-2025	Staff Time	Monroe County OEM
6.1.1	Education and Awareness	Continue to address a list of problem potholes within the county and submit to PennDOT and appropriate municipalities.	Transportation Accident, Hazardous Materials – Transportation		**X**		2021-2025	Staff Time	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
6.2.1	Local Plans and Regulations	Maintain Route 611 transportation planning work group to conduct planning for transportation items related to major interstate shutdowns.	Transportation Accidents and Hazardous Materials – Transportation		**X**		2021-2025	Staff Time	NEPA-MPO and Municipalities along Route 611
6.2.3	Local Plans and Regulations	Maintain a transportation planning work group to conduct planning for transportation items related to major highway shutdowns.	Transportation Accidents and Hazardous Materials – Transportation		**X**		2021-2025	Staff Time	NEPA-MPO and Municipalities along Route 611

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
7.1.1	Education and Awareness	Continue to conduct outreach to private owners of high-hazard dams on the importance of dam safety planning and on mitigation opportunities for dam failure hazards.	Dam Failure	**X**			2021-2025	Staff Time	Monroe County OEM
7.1.2	Education and Awareness	Distribute educational pamphlets about the HHPD program.	Dam Failure	**X**			2021-2025	Staff Time	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
7.1.3	Education and Awareness	Utilize all municipal social media pages to disseminate important information regarding the HHPD program to Monroe County residents.	Dam Failure	**X**			2021-2025	Staff Time	Monroe County Municipalities
7.2.1	Local Plans and Regulations	Incorporate existing plans, studies, reports, and technical information for eligible high-hazard potential dams.	Dam Failure	**X**			2021-2025	Staff Time	Monroe County OEM
7.2.2	Local Plans and Regulations	Enhance local mitigation policies and programs that address high-hazard potential dams.	Dam Failure		**X**		2021-2025	HHPD	Monroe County OEM

Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
7.2.3	Local Plans and Regulations	Secure funding to reduce vulnerability of HHPD.	Dam Failure	**X**			2021-2025	HHPD	Monroe County OEM

Funding acronym definitions:

FMA: Flood Mitigation Assistance Grant Program, administered by the Federal Emergency Management Agency

HMGP: Hazard Mitigation Grant Program, administered by the Federal Emergency Management Agency

BRIC: Building Resilient Infrastructure and Communities (BRIC) Program, administered by the Federal Emergency Management Agency

EMPG: Emergency Management Performance Grant, administered by the Federal Emergency Management Agency

HSGP: Homeland Security Grant Program, administered by the Federal Emergency Management Agency

HMEP: Hazardous Material Emergency Planning Grant, administered by the Pennsylvania Emergency Management Agency

HMRF: Hazardous Material Response Fund, administered by the Pennsylvania Emergency Management Agency

HMERP: Hazard Mitigation Emergency Response Program administered by the Pennsylvania Emergency Management Agency

HHPD: Rehabilitation of High-Hazard Potential Dams Grant Program, administered by the Federal Emergency Management Agency

Table 102 - Municipal Hazard Mitigation Actions Checklist

Municipal Hazard Mitigation Actions Checklist										
Municipality	**1.1.1**	**1.2.1**	**1.2.2**	**1.3.1**	**2.1.1**	**2.1.2**	**2.1.3**	**2.2.1**	**2.2.2**	**2.2.3**
Barrett Township		X		X	X	X	X		X	X
Chestnuthill Township		X		X	X	X	X		X	X
Coolbaugh Township		X		X	X	X	X		X	X
Delaware Water Gap Borough		X		X	X	X	X		X	X
East Stroudsburg Borough		X		X	X	X	X		X	X
Eldred Township		X		X	X	X	X		X	X
Hamilton Township		X		X	X	X	X		X	X
Jackson Township		X		X	X	X	X		X	X
Middle Smithfield Township		X		X	X	X	X		X	X
Mount Pocono Borough		X		X	X	X	X		X	X
Paradise Township		X		X	X	X	X		X	X
Pocono Township		X		X	X	X	X		X	X
Polk Township		X		X	X	X	X		X	X
Price Township		X		X	X	X	X		X	X
Ross Township		X		X	X	X	X		X	X
Smithfield Township		X		X	X	X	X		X	X
Stroud Township		X		X	X	X	X		X	X
Stroudsburg Borough		X		X	X	X	X		X	X
Tobyhanna Township		X		X	X	X	X		X	X
Tunkhanock Township		X		X	X	X	X		X	X
Monroe County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**2.2.4**	**2.2.5**	**2.3.1**	**2.3.2**	**2.4.1**	**2.4.2**	**2.5.1**	**2.5.2**	**2.5.3**	**2.5.4**
Barrett Township	X	X	X	X			X	X	X	X
Chestnuthill Township	X	X	X	X			X	X	X	X
Coolbaugh Township	X	X	X	X			X	X	X	X
Delaware Water Gap Borough	X	X	X	X			X	X	X	X
East Stroudsburg Borough	X	X	X	X			X	X	X	X
Eldred Township	X	X	X	X			X	X	X	X
Hamilton Township	X	X	X	X			X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**2.2.4**	**2.2.5**	**2.3.1**	**2.3.2**	**2.4.1**	**2.4.2**	**2.5.1**	**2.5.2**	**2.5.3**	**2.5.4**
Jackson Township	X	X	X	X			X	X	X	X
Middle Smithfield Township	X	X	X	X			X	X	X	X
Mount Pocono Borough	X	X	X	X			X	X	X	X
Paradise Township	X	X	X	X			X	X	X	X
Pocono Township	X	X	X	X			X	X	X	X
Polk Township	X	X	X	X			X	X	X	X
Price Township	X	X	X	X			X	X	X	X
Ross Township	X	X	X	X			X	X	X	X
Smithfield Township	X	X	X	X			X	X	X	X
Stroud Township	X	X	X	X			X	X	X	X
Stroudsburg Borough	X	X	X	X			X	X	X	X
Tobyhanna Township	X	X	X	X			X	X	X	X
Tunkhanock Township	X	X	X	X			X	X	X	X
Monroe County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**2.5.5**	**3.1.1**	**3.1.2**	**3.1.3**	**3.1.4**	**3.2.1**	**3.3.1**	**3.3.2**	**3.3.3**	**4.1.1**
Barrett Township	X	X	X				X			X
Chestnuthill Township	X	X	X				X			X
Coolbaugh Township	X	X	X				X			X
Delaware Water Gap Borough	X	X	X				X			X
East Stroudsburg Borough	X	X	X				X			X
Eldred Township	X	X	X				X			X
Hamilton Township	X	X	X				X			X
Jackson Township	X	X	X				X			X
Middle Smithfield Township	X	X	X				X			X
Mount Pocono Borough	X	X	X				X			X
Paradise Township	X	X	X				X			X
Pocono Township	X	X	X				X			X
Polk Township	X	X	X				X			X
Price Township	X	X	X				X			X
Ross Township	X	X	X				X			X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**2.5.5**	**3.1.1**	**3.1.2**	**3.1.3**	**3.1.4**	**3.2.1**	**3.3.1**	**3.3.2**	**3.3.3**	**4.1.1**
Smithfield Township	X	X	X				X			X
Stroud Township	X	X	X				X			X
Stroudsburg Borough	X	X	X				X			X
Tobyhanna Township	X	X	X				X			X
Tunkhanock Township	X	X	X				X			X
Monroe County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**4.1.2**	**4.1.3**	**4.1.4**	**4.1.5**	**4.1.6**	**4.1.7**	**4.2.1**	**4.2.2**	**4.3.1**	**4.3.2**
Barrett Township			X	X	X	X	X	X	X	X
Chestnuthill Township			X	X	X	X	X	X	X	X
Coolbaugh Township			X	X	X	X	X	X	X	X
Delaware Water Gap Borough			X	X	X	X	X	X	X	X
East Stroudsburg Borough			X	X	X	X	X	X	X	X
Eldred Township			X	X	X	X	X	X	X	X
Hamilton Township			X	X	X	X	X	X	X	X
Jackson Township			X	X	X	X	X	X	X	X
Middle Smithfield Township			X	X	X	X	X	X	X	X
Mount Pocono Borough			X	X	X	X	X	X	X	X
Paradise Township			X	X	X	X	X	X	X	X
Pocono Township			X	X	X	X	X	X	X	X
Polk Township			X	X	X	X	X	X	X	X
Price Township			X	X	X	X	X	X	X	X
Ross Township			X	X	X	X	X	X	X	X
Smithfield Township			X	X	X	X	X	X	X	X
Stroud Township			X	X	X	X	X	X	X	X
Stroudsburg Borough			X	X	X	X	X	X	X	X
Tobyhanna Township			X	X	X	X	X	X	X	X
Tunkhanock Township			X	X	X	X	X	X	X	X
Monroe County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**4.3.3**	**4.3.4**	**5.1.1**	**5.1.2**	**5.2.1**	**5.2.2**	**5.3.1**	**6.1.1**	**6.2.1**	**6.2.3**
Barrett Township	X	X	X	X	X	X	X	X		X
Chestnuthill Township	X	X	X	X	X	X	X	X		X
Coolbaugh Township	X	X	X	X	X	X	X	X		X
Delaware Water Gap Borough	X	X	X	X	X	X	X	X		X
East Stroudsburg Borough	X	X	X	X	X	X	X	X		X
Eldred Township	X	X	X	X	X	X	X	X		X
Hamilton Township	X	X	X	X	X	X	X	X		X
Jackson Township	X	X	X	X	X	X	X	X		X
Middle Smithfield Township	X	X	X	X	X	X	X	X		X
Mount Pocono Borough	X	X	X	X	X	X	X	X		X
Paradise Township	X	X	X	X	X	X	X	X		X
Pocono Township	X	X	X	X	X	X	X	X		X
Polk Township	X	X	X	X	X	X	X	X		X
Price Township	X	X	X	X	X	X	X	X		X
Ross Township	X	X	X	X	X	X	X	X		X
Smithfield Township	X	X	X	X	X	X	X	X		X
Stroud Township	X	X	X	X	X	X	X	X		X
Stroudsburg Borough	X	X	X	X	X	X	X	X		X
Tobyhanna Township	X	X	X	X	X	X	X	X		X
Tunkhanock Township	X	X	X	X	X	X	X	X		X
Monroe County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist											
Municipality	**7.1.1**	**7.1.2**	**7.1.3**	**7.2.1**	**7.2.2**	**7.2.3**					
Barrett Township		X	X	X	X	X					
Chestnuthill Township		X	X	X	X	X					
Coolbaugh Township		X	X	X	X	X					
Delaware Water Gap Borough		X	X	X	X	X					
East Stroudsburg Borough		X	X	X	X	X					
Eldred Township		X	X	X	X	X					
Hamilton Township		X	X	X	X	X					
Jackson Township		X	X	X	X	X					

Municipal Hazard Mitigation Actions Checklist											
Municipality	**7.1.1**	**7.1.2**	**7.1.3**	**7.2.1**	**7.2.2**	**7.2.3**					
Middle Smithfield Township		**X**	**X**	**X**	**X**	**X**					
Mount Pocono Borough		**X**	**X**	**X**	**X**	**X**					
Paradise Township		**X**	**X**	**X**	**X**	**X**					
Pocono Township		**X**	**X**	**X**	**X**	**X**					
Polk Township		**X**	**X**	**X**	**X**	**X**					
Price Township		**X**	**X**	**X**	**X**	**X**					
Ross Township		**X**	**X**	**X**	**X**	**X**					
Smithfield Township		**X**	**X**	**X**	**X**	**X**					
Stroud Township		**X**	**X**	**X**	**X**	**X**					
Stroudsburg Borough		**X**	**X**	**X**	**X**	**X**					
Tobyhanna Township		**X**	**X**	**X**	**X**	**X**					
Tunkhanock Township		**X**	**X**	**X**	**X**	**X**					
Monroe County	**X**	**X**	**X**	**X**	**X**	**X**					

7. Plan Maintenance

7.1. Update Process Summary

Monitoring, evaluating, and updating this plan, is critical to maintaining its value and success in Monroe County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. The Monroe County HMP Local Planning Team decided to alter the current maintenance procedures. The 2021 HMP update establishes a review of the plan within thirty days of a disaster event in addition to continuing with an annual plan evaluation. This HMP update also defines the municipalities' role in updating and evaluating the plan. Finally, the 2021 HMP update encourages continued public involvement and how this plan may be integrated into other planning mechanisms in the county.

7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Monroe County is a responsibility of all levels of government (i.e., county and local), as well as the citizens of the county. The Monroe County Local Planning Team will be responsible for maintaining this multi-jurisdictional HMP. The local planning team will meet annually and following each emergency declaration to review the plan. Every municipality that has adopted this plan will also be afforded the opportunity to provide updated information or information specific to hazards encountered during an emergency or disaster. Each review process will ensure that the hazard vulnerability data and risk analysis reflect current conditions of the county, that the capabilities assessment accurately reflects local circumstances and that the hazard mitigation strategies are updated based on the county's damage assessment reports and local mitigation project priorities. The HMP must be updated on a five-year cycle. An updated HMP must be completed and approved by the end of the five-year period. The monitoring, evaluating, and updating of the plan every five years will rely heavily on the outcomes of the annual HMP planning team meetings.

The Monroe County Local Planning Team will complete a hazard mitigation progress report to evaluate the status and accuracy of the multi-jurisdictional HMP and record the local planning team's review process. The annual plan review will be distributed to appropriate representatives at both PEMA and FEMA. The following items will be completed during the annual review and reporting process:

- Review the risk assessment section and identify occurrences of hazards within the last year. Identify date, time, damage, fatalities and other specific information of the events. Also identify any new hazards that have occurred or increased risk within the county.
- Complete a review and update of capability assessment section. Identify any capability weaknesses.
- Complete a review of the mitigation strategy section. Review the goals and objectives identified in the 2021 HMP and determine if any updates are needed. Provide all mitigation actions and opportunities to the county and municipalities that are applicable. Have all entities complete an action review matrix and document all results in the report. Also, add any new actions that are identified. Complete a review of each mitigation opportunity and identify the status of each opportunity on the opportunity review spreadsheet. All information will be included in the annual review report.

The Monroe County Office of Emergency Management will maintain a copy of these records and place them in Appendix I of this plan. Monroe County will continue to work with all municipalities regarding hazard mitigation projects, especially those municipalities that did not submit projects for inclusion in this plan.

7.3. Continued Public Involvement

The Monroe County Office of Emergency Management will ensure that the 2021 Monroe County Hazard Mitigation Plan is posted and maintained on the Monroe County website and will continue to encourage public review and comment on the plan. The Monroe County website that the plan will be located at is as follows: http://www.monroecountypa.gov/hazmit

The public will have access to the 2021 HMP through their local municipal office, the Monroe County Planning Commission, or the Monroe County Office of Emergency Management. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and the county website.

The citizens of Monroe County are encouraged to submit their comments to elected officials and/or members of the Monroe County HMP Local Planning Team. To promote public participation, the Monroe County Local Planning Team will post a public comment form as well as the Hazard Mitigation Project Opportunity Form on the county's website. These forms will offer the public various opportunities to supply their comments and observations. All comments received will be maintained and considered by the Monroe County Hazard Mitigation Planning Team.

8. Plan Adoption

8.1. Resolutions

In accordance with federal and state requirements, the governing bodies of each participating jurisdiction must review and adopt by resolution, the 2021 Monroe County Hazard Mitigation Plan. Copies of the adopting resolutions are included in this plan in Appendix J. FEMA Region III in Philadelphia is the final approval authority for the Hazard Mitigation Plan. PEMA also reviews the plan before submission to FEMA.

9. Appendices

APPENDIX A: **References**

APPENDIX B: **FEMA Local Mitigation Review Tool**

APPENDIX C: **Meetings and Support Documents**

APPENDIX D: **Municipal Flood Maps**

APPENDIX E: **Critical and Special Needs Facilities**

APPENDIX F: **2021 HAZUS Reports**

APPENDIX G: **2021 Mitigation Project Opportunities**

APPENDIX H: **2021 Mitigation Action Evaluation & Prioritization**

APPENDIX I: **Annual Review Documentation**

APPENDIX J: **Monroe County & Municipal Adoption Resolutions**