

Monroe County 2025 Hazard Mitigation Plan

Prepared for:

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Produced by MCM Consulting Group, Inc.



***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Certification of Annual Review Meetings

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2025			
2026			
2027			
2028			
2029			

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

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2025 Hazard Mitigation Plan***

Record of Changes

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

Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Table of Contents

Certification of Annual Review Meetings	2
Record of Changes	3
Table of Contents	4
Figures	7
Tables	9
Acronyms/Initializations	12
Executive Summary	17
1. Introduction	20
1.1. Background	20
1.2. Purpose	20
1.3. Scope	21
1.4. Authority and References	21
2. Community Profile	23
2.1. Geography and the Environment	23
2.2. Community Facts	25
2.3. Population and Demographics	27
2.4. Land Use and Development	35
2.5. Data Sources and Limitations	36
3. Planning Process	45
3.1. Update Process and Participation Summary	45
3.3. Meetings and Documentation	55
3.4. Public and Stakeholder Participation	57
3.5. Multi-Jurisdictional Planning	59
4. Risk Assessment	61
4.1. Update Process Summary	61
4.2. Hazard Identification	62
4.2.1. Presidential and Gubernatorial Disaster Declarations	62

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

4.2.2.	Summary of Hazards	64
4.2.3.	Climate Change	70
4.3.	Hazard Profiles	72
4.3.1.	Drought	72
4.3.2.	Extreme Temperature	85
4.3.3.	Flooding, Flash Flooding, and Ice Jam Flooding	94
4.3.4.	Hurricane/Tropical Storm	115
4.3.5.	Invasive Species	125
4.3.6.	Pandemic, Epidemic, Endemic, and Infectious Disease	139
4.3.7.	Tornadoes/Windstorm	151
4.3.8.	Wildfire	165
4.3.9.	Winter Storm	179
4.3.10.	Dam and Levee Failure	193
4.3.11.	Disorientation	212
4.3.12.	Drowning	216
4.3.13.	Environmental Hazards	220
4.3.14.	Nuclear Incidents	231
4.3.15.	Substance Use Disorder	240
4.3.16.	Terrorism/Cyberterrorism	250
4.3.17.	Transportation Accidents	261
4.3.18.	Utility Interruption	270
4.4.	Hazard Vulnerability Summary	278
4.4.1.	Methodology	278
4.4.2.	Ranking Results	280
4.4.4.	Future Development and Vulnerability	286
5.	Capability Assessment	288
5.1.	Update Process Summary	288
5.2.	Capability Assessment Findings	289
5.2.1.	Planning and Regulatory Capability	289
5.2.2.	Administrative and Technical Capability	297

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

5.2.3.	Financial Capability.....	301
5.2.4.	Education and Outreach	305
5.2.5.	Plan Integration	307
6.	Mitigation Strategy.....	309
6.1.	Update Process Summary.....	309
6.2.	Mitigation Goals and Objectives.....	323
6.3.	Identification and Analysis of Mitigation Techniques.....	325
6.4.	Mitigation Action Plan.....	328
7.	Plan Maintenance	353
7.1.	Update Process Summary	353
7.2.	Monitoring, Evaluating and Updating the Plan	353
7.3.	Continued Public Involvement.....	354
8.	Plan Adoption	356
8.1.	Resolutions	356
9.	Appendices	357
APPENDIX A:	References	357
APPENDIX B:	FEMA Local Mitigation Review Tool.....	357
APPENDIX C:	Meetings and Support Documents.....	357
APPENDIX D:	Municipal Flood Maps	357
APPENDIX E:	Critical and Community Lifeline Facilities.....	357
APPENDIX F:	2025 HAZUS Reports	357
APPENDIX G:	2025 Mitigation Project Opportunities	357
APPENDIX H:	2025 Mitigation Action Evaluation & Prioritization	357
APPENDIX I:	Annual Review Documentation	357
APPENDIX J:	Monroe County & Municipal Adoption Resolutions.....	357

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figures

Figure 1 - Köppen-Geiger Climate Map	24
Figure 2 - Unemployment Rate Jan. 2014 to Feb. 2024.....	31
Figure 3 - Monroe County Basemap.....	41
Figure 4 - Monroe County Watersheds.....	42
Figure 5 - Monroe County Population Density.....	43
Figure 6 - Monroe County Land Use.....	44
Figure 7 - Current Drought Index for Pennsylvania	78
Figure 8 - Palmer Drought Severity Index.....	83
Figure 9 - Drought-Vulnerable Land Use and Public Water Supply	84
Figure 10 - National Weather Service’s Heat Index Matrix	86
Figure 11 - National Weather Service’s Wind Chill Matrix	87
Figure 12 - Observed and Projected Temperature Change for Pennsylvania.....	89
Figure 13 - Average Minimum Temperature Trends for Pennsylvania.....	92
Figure 14 - Average Maximum Temperature Trends for Pennsylvania	93
Figure 15 - Flooding and Floodplain Diagram	95
Figure 16 - Loss by Occupancy Type	98
Figure 17 - Pennsylvania Wind Zones.....	122
Figure 18 - Historic Tropical Storms/Hurricanes in Pennsylvania.....	123
Figure 19 - Monroe County Hurricane Impacts.....	124
Figure 20 - Emerald Ash Borer Infestation in Pennsylvania	126
Figure 21 - Hemlock Woolly Adelgid Infestation in Pennsylvania.....	127
Figure 22 - Pennsylvania Spotted Lanternfly Infestation	138
Figure 23 - Pennsylvania Department of Health Districts	150
Figure 24 - Pennsylvania Wind Zones.....	162
Figure 25 - Tornado Activity in Pennsylvania.....	163
Figure 26 - Tornado Activity in Monroe County.....	164
Figure 27 - Seasonal Wildfire Percentage	173
Figure 28 - Wildland Urban Interface.....	177
Figure 29 - Fire Station Locations	178
Figure 30 - Winter Storm Events by County in Pennsylvania.....	191
Figure 31 - Pennsylvania Annual Snowfall 1981 – 2010	192
Figure 32 - Monroe County Dams	209
Figure 33 - Monroe County Levee Locations.....	210
Figure 34 - Levee Locations – Stroudsburg and East Stroudsburg	211
Figure 35 - Monroe County Disorientation Vulnerability	215
Figure 36 - Drowning Hazards – Water Features	219
Figure 37 - Hazardous Waste Locations.....	228

*Monroe County, Pennsylvania
2025 Hazard Mitigation Plan*

Figure 38 - Environmental Hazard Transportation Vulnerability..... 229

Figure 39 - Annual Truck Traffic Percentages 230

Figure 40 - Pennsylvania Nuclear Power Stations..... 238

Figure 41 - Monroe County Municipalities in the 50-Mile Ingestion Exposure Pathways 239

Figure 42 - Opioid Overdose Deaths in Pennsylvania 2021 248

Figure 43 - Opioid Overdose Deaths in Pennsylvania 2022 249

Figure 44 - Active Shooter Incidents - 20 Year Active Shooter Summary 255

Figure 45 - Education Environments 256

Figure 46 - Major Transportation Routes 266

Figure 47 - Airports and Vulnerability Zones..... 267

Figure 48 - Average Daily Traffic on Major Highway Vulnerability 268

Figure 49 - Utility Pipelines Vulnerability 269

Figure 50 - Monroe County Utilities 277

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Tables

Table 1 - Watersheds in Monroe County	25
Table 2 - Monroe County National Historic Places	26
Table 3 - Population Change in Monroe County	28
Table 4 - Monroe County Top Employers	31
Table 5 - Quarterly Census of Employment and Wages, 2023 Annual Averages in Monroe County	32
Table 6 - Steering Committee	47
Table 7 - Local Planning Team	49
Table 8 - HMP Process Timeline	56
Table 9 - Municipality Worksheets, Surveys, and Forms Participation	59
Table 10 - Presidential & Gubernatorial Disaster Declarations	62
Table 11 - Drought Preparation Phases	74
Table 12 - Palmer Drought Severity Index	75
Table 13 - Economic and Environmental Impacts of Drought Events	75
Table 14 - Past Drought Events in Monroe County	76
Table 15 - Monroe County Palmer Drought Severity Index 1895-1995	77
Table 16 - Past Extreme Temperature Occurrences for Monroe County	88
Table 17 - Flood Hazard High Risk Zones	96
Table 18 - HAZUS Building Loss Figures	98
Table 19 - HAZUS Business Interruption Economic Loss Figures	98
Table 20 - Past Flood and Flash Flood Events	99
Table 21 - Repetitive Loss Properties	102
Table 22 - Summary of Type of Repetitive Loss Properties by Municipality	105
Table 23 - Severe Repetitive Loss Properties	105
Table 24 - Municipal NFIP Policies & Vulnerability	106
Table 25 - Flood Probability Summary	107
Table 26 - Expected Damage to Essential Facilities (HAZUS)	108
Table 27 - County Structures Within Special Flood Hazard Area	109
Table 28 - Community Lifeline Facilities Additional Information	110
Table 29 - Saffir-Simpson Scale	116
Table 30 - History of Coastal Storms Impacting Monroe County	117
Table 31 - Annual Probability of Wind Speeds	119
Table 32 - Prevalent Invasive Species	129
Table 33 - Future Vulnerable Species	132
Table 34 - Pandemic Influenza Phases	141
Table 35 - Past Pandemic Events in the United States	143
Table 36 - West Nile Virus Control Program in Monroe County since 2019	144
Table 37 - Lyme Disease Data for Monroe County	145

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 38 - Enhanced Fujita Scale	153
Table 39 - Monroe County Tornado History	156
Table 40 - Monroe County High Wind History.....	156
Table 41 - Wildland Fire Assessment System	166
Table 42 - Annual Summary of Wildfire Events in District 19.....	167
Table 43 - Wildfire Events in Monroe County	168
Table 44 - NESIS Winter Storm Rankings.....	181
Table 45 - Recent Annual Snowfall Estimates	182
Table 46 - Monroe County Winter Weather History	183
Table 47 - Population per Municipality under 5 Years or 65 Years or Older	187
Table 48 - Utility Outages in Monroe County in Winter.....	187
Table 49 - High-Hazard Dams Municipality Summary.....	194
Table 50 - Monroe County Dam Inventory	194
Table 51 - Dam Name and Purpose	201
Table 52 - Monroe County Levee Inventory	203
Table 53 - Dam Classification	206
Table 54 - Number of Vulnerable Structures within Leveed Areas	208
Table 55 - Search and Rescue Operations in Monroe County 2021 to 2023.....	213
Table 56 - Water Rescue/Drownings in Monroe County 2021 to 2023	217
Table 57 - Hazardous Material Incidents.....	223
Table 58 - TRI Facilities	224
Table 59 - Oil and Gas Wells & Drinking Water Wells	227
Table 60 - Emergency Planning Zones.....	232
Table 61 - Drug Overdose Mortality In Monroe County.....	242
Table 62 - Drugs Present in 2020 Pennsylvania Overdose Deaths.....	243
Table 63 - PennDOT Crash Report for Monroe County.....	263
Table 64 - Monroe County Utility Providers.....	270
Table 65 - Utility Interruptions in Monroe County	272
Table 66 - 2018 Winter Storms Riley and Quinn Power Outages.....	273
Table 67 - Risk Factor Approach Summary	278
Table 68 - Risk Factor Approach Summary Cont'd	279
Table 69 - Risk Factor Assessment.....	280
Table 70 - Countywide Risk Factor	282
Table 71 - 2010 – 2020 Population Change.....	286
Table 72 - Monroe County Municipal Floodplain Administrator Designees	297
Table 73 - 2021 Mitigation Goals and Objectives Review.....	310
Table 74 - 2021 Mitigation Actions Review.....	314
Table 75 - 2025 Goals and Objectives.....	323
Table 76 - Mitigation Strategy Technique Matrix	328
Table 77 - 2025 Mitigation Action Plan	332

Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Table 78 - Municipal Hazard Mitigation Actions Checklist..... 346

Table 79 - Objective to Action Checklist 350

Table 80 - Actions Tied to Hazard..... 351

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Acronyms/Initializations

AACT:	American Academy of Clinical Toxicology
ACHA:	American College Health Association
ACMT:	American College of Medical Toxicology
AHJ:	Authority Having Jurisdiction
AMD:	Acid Mine Drainage
ANSI:	American National Standards Institute
ASAM:	American Society of Addiction Medicine
ASHRAE:	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASIRT:	Association for Safe International Road Travel
BFE:	Base Flood Elevation
CAP-SSSE:	Community Assistance Program – State Support Services Element
CBD:	Cannabidiol
CBRNE:	Chemical, Biological, Radiological, Nuclear, or Explosive
CDBG:	Community Development Block Grant
CDC:	Centers for Disease Control and Prevention
CERT:	Community Emergency Response Team
CFR:	Code of Federal Regulations
CFS:	Commodity Flow Study
CHSN:	College Health Surveillance Network
CCIDRAP:	Center for Infectious Disease Research and Policy
COVID-19:	Coronavirus disease 19
CR:	Community Revitalization
CRS:	Community Rating System
DDAP:	Department of Drug and Alcohol Programs
DEA:	Drug Enforcement Administration
DFIRM:	Digital Flood Insurance Rate Map
DMA:	Disaster Mitigation Act
DPS:	Department of Public Safety
DSM-5:	Diagnostic and Statistical Manual of Mental Disorders

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

EAL:	Emergency Action Level
EDA:	Economic Development Authority
EDC:	Electric Distribution Companies
EF:	Enhanced Fujita
EHP:	Environmental Planning and Historic Preservation Program
EIA:	Energy Information Administration
EMA:	Emergency Management Agency
EMPG:	Emergency Management Performance Grant
EMI:	Emergency Management Institute
EMS:	Emergency Medical Services
EMT:	Emergency Medical Technician
EOP:	Emergency Operations Plan
EPA:	Environmental Protection Agency
EPCRA:	Emergency Planning and Community Right-To-Know Act
EPZ:	Emergency Planning Zone
FBI:	Federal Bureau of Investigations
FEMA:	Federal Emergency Management Agency
FMA:	Flood Mitigation Assistance Grant Program
FPMS:	Flood Plain Management Services Program
FRA:	Federal Railroad Association
GIS:	Geographic Information Systems/Sciences
HAZUS:	Hazards U.S. Software
HMA:	Hazard Mitigation Assistance
HMEP:	Hazardous Material Emergency Planning Grant
HMGP:	Hazard Mitigation Grant Planning
HMP:	Hazard Mitigation Plan
HMRF:	Hazardous Material Response Fund
HSCA:	Hazardous Sites Cleanup Act
HSGP:	Homeland Security Grant Program
HUD:	U.S. Department of Housing and Urban Development

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

HVE:	Homegrown Violent Extremist
ICC:	International Code Council
ICW:	Inspection of Completed Works Program
IES:	Illuminating Engineering Society
IHAP:	Individuals and Households Program
KKK:	Ku Klux Klan
LEPC:	Local Emergency Planning Committee
LGBTQIA+:	Lesbian, Gay, Bisexual, Trans, Queer, Intersex, Asexual, and other sexual identities
LPT:	Local Planning Team
LUPTAP:	Land Use Planning and Technical Assistance
MAT:	Medication-Assisted Treatment
MPC:	Municipalities Planning Code
MPH:	Miles Per Hour
NARM:	Notification and Resource Manual
NAS:	Neonatal Abstinence Syndrome
NCDC:	National Climatic Data Center
NCEI:	National Centers for Environmental Information
NFIP:	National Flood Insurance Program
NFPA:	National Fire Protection Association
NIDA:	National Institute on Drug Abuse
NIH:	National Institute of Health
NLD:	National Levee Database
NOAA:	National Oceanic and Atmospheric Administration
NRA:	National Recreation Area
NTP:	Narcotic Treatment Program
NWS:	National Weather Service
OIH:	Opioid-Induced Hyperalgesia
ODU:	Opioid Use Disorder
PA:	Public Assistance Program
PA COC:	Pennsylvania Continuums of Care

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

PA DCED:	Pennsylvania Department of Community and Economic Development
PA DCNR:	Department of Conservation and Natural Resources
PA DEP:	Pennsylvania Department of Environmental Protection
PA DMP:	Pennsylvania's Prescription Drug Monitoring Program
PA DOA:	Pennsylvania Department of Agriculture
PA GWIS:	Pennsylvania Groundwater Information System
PA HART:	Pennsylvania Helicopter Aquatic Rescue Team
PAG:	Protective Action Guide
PASSHE:	Pennsylvania State System of Higher Education
PAWNVCP:	Pennsylvania West Nile Virus Control Program
PDM:	Pre-Disaster Mitigation Grant
PDMP:	Prescription Drug Monitoring Program
PDSI:	Palmer Drought Severity Index
PEMA:	Pennsylvania Emergency Management Agency
PennDOT:	Pennsylvania Department of Transportation
PHMSA:	Pipeline and Hazardous Materials Safety Administration
PISC:	Pennsylvania Invasive Species Council
PIT:	Point-In-Time
PNERRA:	Pennsylvania Northeast Regional Railroad Authority
POD:	Points of Dispensing
PSAP:	Public Safety Answering Point
PWSA:	Public Water Service Area
QLCS:	Quasi-Linear Convective Systems
RF:	Risk Factor
RFC:	Repetitive Flood Claims Program
RIP:	Rehabilitation and Inspection Program
SARA:	Superfund Amendments and Reauthorization Act
SBA:	Small Business Administration
SC:	Steering Committee

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

SFHA:	Special Flood Hazard Area
SMS:	Shared Municipal Services
SUD:	Substance Use Disorder
THC:	Tetrahydrocannabinol
TRI:	Toxic Release Inventory
UCC:	Uniform Construction Code
US HHS:	United States Department of Health and Human Services
USACE:	United States Army Corp of Engineers
USDA:	United States Department of Agriculture
USDA FS:	United States Department of Agriculture Forest Service
USGS:	United States Geological Survey
WHO:	World Health Organization
WL:	Working Level
WMD:	Weapon of Mass Destruction
WUI:	Wildland Urban Interface

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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 2024, the 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 2021 Monroe County Hazard Mitigation Plan as the municipal hazard mitigation plan, and it is anticipated that all participating municipalities will adopt the 2025 Monroe County Hazard Mitigation Plan Update.

The Monroe County Commissioners secured a grant to complete the 2025 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 on January 3, 2024.

The planning process for the 2025 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. To maximize the overall planning process and public involvement, public meetings were conducted via an online platform and online surveys were provided to residents to gather input on the HMP. Several meetings were held in person with a virtual option, and participants were invited to submit surveys and other documents via an online survey.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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

Natural hazards:

- Drought
- Extreme Temperatures
- Flooding, Flash Flooding, Ice Jam Flooding
- Hurricane and Tropical Storm
- Invasive Species
- Pandemic, Epidemic, and Infectious Disease
- Endemic
- Tornado/Windstorm
- Wildfire
- Winter Storm

Human-caused hazards:

- Dam and Levee Failure
- Disorientation
- Drowning
- Environmental Hazards / Hazardous Materials
- Nuclear Incident
- Substance Use Disorder
- Terrorism/Cyberterrorism Incidents
- Transportation Accidents
- Utility Interruption

A total of eighteen hazard profiles have been identified in the 2025 Monroe County Hazard Mitigation Plan. A total of twenty-two identified hazards were listed in the previous 2021 plan update. There were no new hazards included in the 2025 plan.

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 community assets due to all hazards.
- Promote disaster-resistant future development.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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-seven actions were developed for this plan update as they pertain to hazards identified by the local planning team. The 2021 Monroe County Hazard Mitigation Plan consisted of fifty-six 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-three project opportunity forms were submitted during the 2021 HMP update. A total of 138 project opportunities were submitted for this plan update, 109 of them being from municipalities.

The 2025 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 2025 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.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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, all of its twenty municipalities, and East Stroudsburg University. The Monroe County Office of Emergency Management was charged by the County Board of Commissioners to prepare the 2025 plan. The 2021 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 cycles 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 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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. 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, 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 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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

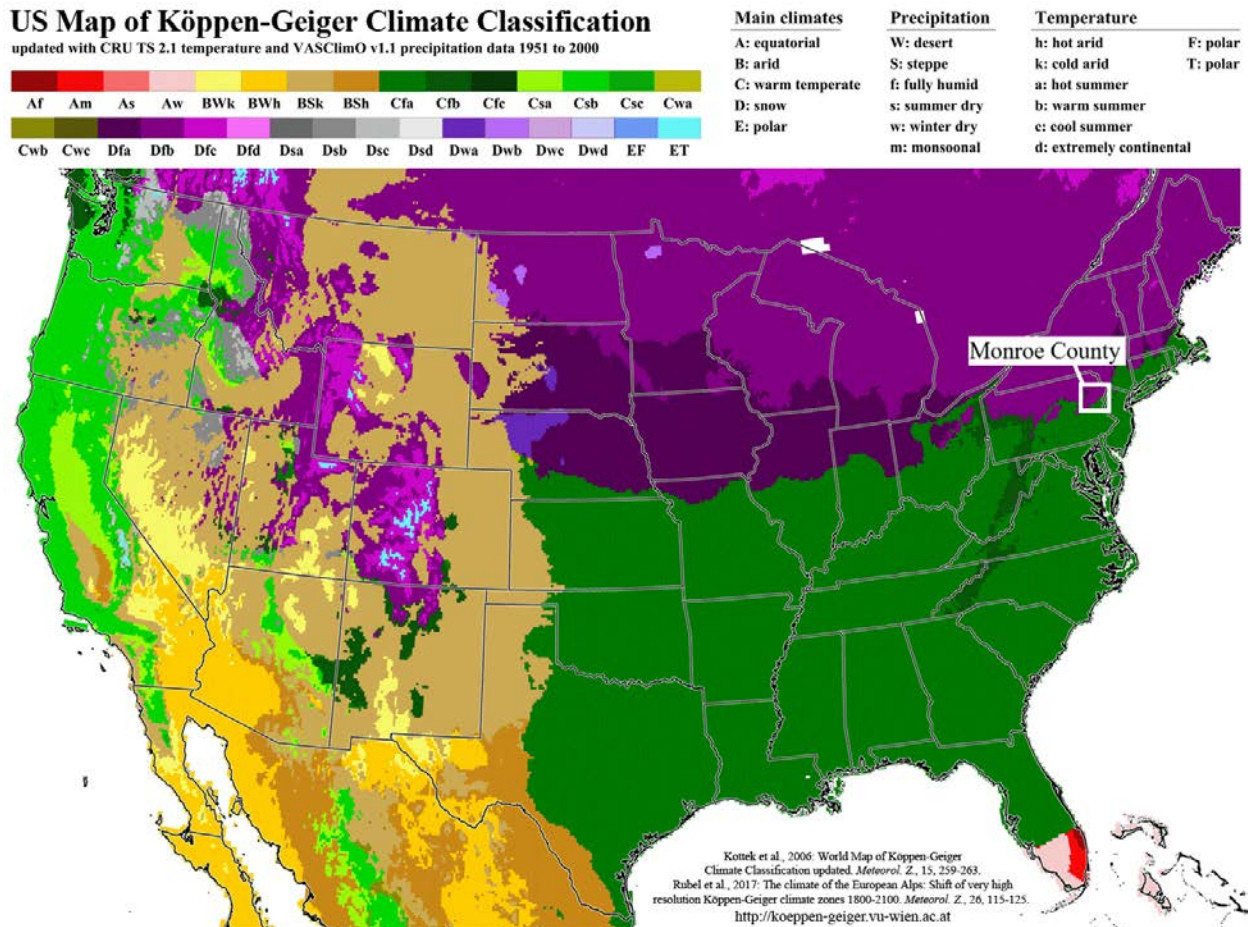
Monroe County covers approximately 617 square miles and is situated in the northeastern region of Pennsylvania. The county is bordered by Carbon County and Luzerne County to the west, by Lackawana to the northwest, by Wayne County to the north, by Pike County to the northeast, by Sussex County, New Jersey, to the northeast, by Warren County, New Jersey to the east, and by Northampton County to the south. Monroe County lies within two physiographic provinces of Pennsylvania—the Appalachian Plateaus and the Ridge and Valley Province. The division between the two provinces is marked by the Allegheny Front, which trends along a northeast-southwest axis, northwest of the town of Lock Haven. The county is the 20th ranked county in terms of population within the Commonwealth of Pennsylvania. There is a total of approximately 608 square miles of land and nine square miles of water.

Monroe County presents a wide range of topographic features. The surface ranges from almost level on plateaus and in valleys, to rolling and hilly in other areas. Elevations in the county range from a high of 2,215 feet near Kistler Ledge in the Pocono Mountains in the northcentral area of Monroe County to a low of 288 feet near Delaware Water Gap Borough along the Delaware River.

The Köppen-Geiger Climate Areas map classifies Monroe County, and the rest of Pennsylvania, as Humid Continental, which can be seen in *Figure 1 – Köppen-Geiger Climate Map*. While the counties of Pennsylvania share many weather similarities, there are also a few unique characteristics to the area.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 1 - Köppen-Geiger Climate Map



According to current data, the climate in Monroe County is temperate, characterized by moderately hot summers and moderately severe winters. In winter, the average temperature is 30.56°F and the average daily minimum temperature is 4.47°F. In summer, the average temperature is 70.13°F and the average daily maximum temperature is 92.17°F. The average amount of snowfall each winter is 10.51 inches.

River and stream valleys dominate the landscape of Monroe County. The Delaware River is the primary water feature in Monroe County and runs along the eastern side of the entire county. Its major tributaries include Broadhead Creek, Pocono Creek, and McMichael Creek. Monroe County is comprised of thirty-four watersheds:

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 1 - Watersheds in Monroe County

Watersheds in Monroe County
Aquashicola Creek
Brodhead Creek
Bush Kill
Flat Brook-Delaware River
Middle Lehigh River
Pocono Creek
Pohopoco Creek
Tobyhanna Creek
Upper Delaware River
Upper Lehigh River
Wallenpaupack Creek

2.2. Community Facts

Monroe County, Pennsylvania was created on April 1, 1836. The county was created from sections of Northampton and Pike counties. The county is named for James Monroe, the fifth president of the United States. The county seat is Stroudsburg Borough and was named after Colonel Jacob Stroud, who laid out the borough. The borough was established in 1815.

The following boroughs and townships are located in Monroe County:

Boroughs (4):

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

Townships (16):

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Paradise Township
- Pocono Township

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stround Township
- Tobyhanna Township
- Tunkhannock Township

There are five museums and multiple municipal historical societies located in Monroe County. The museums are the Antoine Dutot Museum and Gallery, the Frazetta Art Museum, the Quiet Valley Farm, the Schisler Museum and McMunn Planetarium, and the Stroud Museum Mansion. The Antoine Dutot Museum is an art museum that also houses local artifacts and historical items. The Frazetta Art Museum displays art from American artist Frank Frazetta. The Quiet Valley Farm is a working historic farm and open-air museum. This location is only open seasonally in Monroe County. The Schisler Museum and McMunn Planetarium are attached to the East Stroudsburg University and has more than one hundred wildlife species. The Stroud Mansion is a museum and also houses the Monroe County Historical Society.

The National Park Service's (NPS) National Register of Historic Places lists twenty-two locations in Monroe County that are considered historic properties, districts, or buildings. These properties, buildings, or districts can be found in *Table 2 – Monroe County National Historic Places*, including the year that the building was added to the list and the municipality where it is located. The National Park Service also has multiple National Recreation Areas (NRA) across the country. The only NRA in the Commonwealth, the Delaware Water Gap National Recreation Area, is in Monroe County. This NRA also crosses the Delaware River into New Jersey.

Table 2 - Monroe County National Historic Places

Monroe County National Historic Places		
Building/Location Name	Date Added to NRHP	Municipality
Academy Hill Historic District	January 4 th , 1990	Stroudsburg Borough
Christ Hamilton United Lutheran Church and Cemetery	June, 11 th , 1980	Hamilton Township
Captain Jacob Shoemaker House	July 17 th , 1979	Middle Smithfield Township
Cold Spring Farm Springhouse	August 24 th , 1979	Middle Smithfield Township
Delaware, Lackawanna, and Western Railroad Water Gap Station	November 27 th , 2002	Delaware Water Gap Borough
East Stroudsburg Armory	May 9 th , 1991	East Stroudsburg Borough

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Monroe County National Historic Places		
Building/Location Name	Date Added to NRHP	Municipality
East Stroudsburg Railroad Station	June 27 th , 1980	East Stroudsburg Borough
Fenner-Snyder Mill	May 13 th , 1976	Hamilton Township
Frantz School	September 16 th , 2022	Eldred Township
John Michael Farm	July 8 th , 1980	Middle Smithfield Township
John Turn Farm	July 23 rd , 1979	Middle Smithfield Township
Kitson Woolen Mill	January 12, 1984	Stroudsburg Borough
Monroe County Courthouse	April 18 th , 1979	Stroudsburg Borough
Parkside Chapel	October 7 th , 2022	Paradise Township
Pocono Manor Historic District	April 11 th , 1997	Pocono Township
Quiet Valley Farm	April 23 rd , 1973	Stroudsburg Borough
Ross Common Manor	November 22 nd , 1978	Ross Township
Schoonover Mountain House	August 21 st , 1979	Middle Smithfield Township
Shawnee-Minisink Site	November 9 th , 2007	Smithfield Township
Shrawder-Sittig House	June 22 nd , 2023	Smithfield Township
Stroud Mansion	August 1 st , 1979	Stroudsburg Borough
Zion Lutheran Church	November 9 th , 1972	Middle Smithfield Township
Source: NPS NRHP, 2024		

2.3. Population and Demographics

The total population for Monroe County is 168,327 based on 2020 United States Census Bureau. The total change in population for Monroe County from 2010 to 2020 was a decrease of 1,515 and a change of 0.9%. The most populous municipality is Coolbaugh Township followed by Stroud Township. The municipalities in the county that had the largest percentage of decrease from 2010 to 2020 were Delaware Water Gap Borough with a decrease of 16.8% and Stroudsburg Borough with a decrease of 3.8%. The municipalities that had the highest percentage of increase for the period from 2010 to 2020 were Price Township with an increase of 5.5%, Smithfield Township with an increase of 4.1%, and Tobyhanna Township with an increase of 2.5%. *Table 3 – Population Change in Monroe County* illustrates the trends and data from United States Census Bureau. These figures are based off data from the United States Census Bureau in 2020. *Figure 5 – Monroe County Population Density* illustrates the average population density values per census tract in the various municipalities of Monroe County.

American Community Survey

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

The data that is utilized for demographic analysis within this hazard mitigation plan update primarily comes from the American Community Survey (ACS), which is a program of the United States Census Bureau. The information from the ACS provides annual update estimates to population and demographic figures. This information is considered an additional resource for hazard mitigation planning in years between the decennial census. Unless otherwise noted in data analysis, the data presented in this plan is from the 2023 ACS estimates for Monroe County. The United States Census Bureau outlines that “some estimates presented here come from sample data, and thus have sampling errors that may render some apparent differences between geographies statically indistinguishable” (US Census Bureau, QuickFacts, 2025).

Table 3 - Population Change in Monroe County

Population Change in Monroe County from 2010-2020			
Municipality	2010 Census	2020 Census	Percent of Change 2010-2020
Barrett Township	4,260	4,120	-3.3
Chestnuthill Township	17,072	16,879	-1.1
Coolbaugh Township	20,060	20,451	1.9
Delaware Water Gap Borough	794	661	-16.8
East Stroudsburg Borough	10,000	10,232	2.3
Eldred Township	2,898	2,936	1.3
Hamilton Township	9,134	8,905	-2.5
Jackson Township	7,002	6,888	-1.6
Middle Smithfield Township	15,556	15,798	1.6
Mount Pocono Borough	3,172	3,106	-2.1
Paradise Township	3,175	3,120	-1.7
Pocono Township	11,068	10,975	-0.84
Polk Township	7,810	7,724	-1.1
Price Township	3,481	3,673	5.5
Ross Township	5,991	5,875	-1.9
Smithfield Township	7,217	7,515	4.1
Stroud Township	18,716	19,160	2.4
Stroudsburg Borough	5,733	5,514	-3.8
Tobyhanna Township	8,326	8,532	2.5
Tunkhannock Township	6,615	6,760	2.2
Source: United States Census Bureau (2024), 2020 Census Data			

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

There are approximately 79,377 housing units in Monroe County, Pennsylvania. Of these housing units, there are an estimated 59,113 households within the county, with an average size of 2.8 persons. Married couples make up a plurality of households in the county with 54.1%. The estimated owner-occupied housing rate of Monroe County is 78.7%, with an overall occupancy rate of 74.5% of all units. The median value of the owner-occupied housing units in Monroe County from the 2023 American Community Survey is \$221,100.00. The median monthly owner's costs for a structure with a mortgage was \$1,762.00 and the median monthly owner's costs for a structure without a mortgage was \$750.00. The median gross rent for rental properties in Monroe County was \$1,311.00 for the same date range.

The racial composition of the county is 75.7% White, 17.6% Black or African American, 18.7% Hispanic or Latino, 0.7% American Indian and Alaska Native, 2.8% Asian, 0.2% native Hawaiian and other Pacific Islander, and 3.1% two or more races. According to the United Census Bureau, those of Hispanic or Latino descent may be of any race, so are also included in applicable race categories. The median age of Monroe County is 43.5 years of age, which is higher than the median age of Pennsylvania at 40.8 and the national median of 38.5 years of age. The percentage of Monroe County under the age of 5 years old is 4.6%, between the ages of 18 and 64 years old is 77.1%, and aged 65 years old and older is 18.3%.

There are additional languages in spoken in Monroe County other than English. There is a large portion of the county that speaks Spanish, Polish, and other Indo-European languages at home. There are an estimated 8,213 people within Monroe County that “speak English less than ‘very well’” based on the American Community Survey for 2023. Also, a breakdown of the languages spoken at home for population over 5 years of age by municipality can be found in the table below:

Municipality	Language Spoken at Home (Population over 5 years of age)				
	English Only	Spanish	Other Indo-European	Asian and Pacific Islander	Other
Barrett Township	3,130	386	337	0	0
Chestnuthill Township	14,317	613	801	108	93
Coolbaugh Township	15,172	3,416	961	33	89
Delaware Water Gap Borough	538	49	5	0	0
East Stroudsburg Borough	7,782	506	376	148	243
Eldred Township	2,393	17	64	0	0
Hamilton Township	7,115	680	184	194	52

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Municipality	Language Spoken at Home (Population over 5 years of age)				
	English Only	Spanish	Other Indo-European	Asian and Pacific Islander	Other
Jackson Township	5,525	300	378	161	0
Middle Smithfield Township	11,791	2,011	1,110	145	156
Mount Pocono Borough	1,937	563	334	123	0
Paradise Township	2,198	273	129	40	0
Pocono Township	8,377	628	594	461	270
Polk Township	6,144	401	367	95	0
Price Township	2,910	355	203	0	61
Ross Township	4,680	344	39	106	15
Smithfield Township	7,011	549	188	51	0
Stroud Township	15,378	1,901	1,343	236	102
Stroudsburg Borough	4,472	695	145	201	61
Tobyhanna Township	7,046	653	208	80	50
Tunkhannock Township	5,669	620	123	129	41
Source: US Census Bureau, American Community Survey, 2023					

The Polish populations of Monroe County are located primarily around East Stroudsburg Borough. The Monroe County Steering Committee outlined that there is one Polish school in Monroe County. This Polish school is located at the Barrett Township Administrative and Recreation Complex. The headmaster of the Polish school outlined that the school typically sees a student population of 200 that are between the ages of three and those children attending eighth grade.

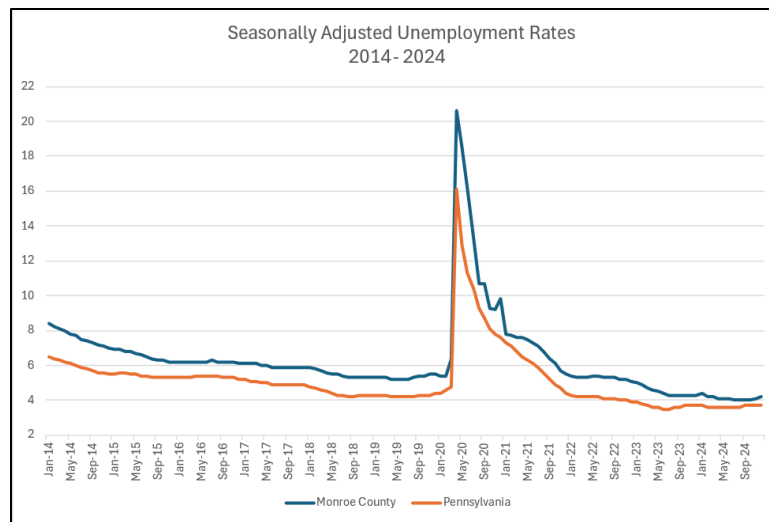
The median household income for households in Monroe County is \$80,656.00 and the poverty rate of Monroe County is 12.3% of the total population. The poverty rate for the Commonwealth of Pennsylvania as a whole is 8%. There are approximately 10,531 veterans in Monroe County.

The COVID-19 pandemic created an increase in unemployment and interruptions in employment throughout the United States, including Pennsylvania and Monroe County. According to Pennsylvania Department of Labor and Industry data, there was a large spike in unemployment both across the Commonwealth and Monroe County. At the height of the COVID-19 Pandemic in the spring of 2020, the unemployment rate for Monroe County hit 20.7% of the working population of the county. That is higher than the peak unemployment percentage for Pennsylvania, which peaked at 16.1% of the working population of the entire state. *Figure 2 –*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Unemployment Rate Jan. 2014 to Feb. 2024 illustrates the trend and large spike in unemployment. The unemployment rate for Monroe County in February of 2024 was 4.3%, which roughly accounted for 3,500 working age adults (ages 16 to 65). The total estimated workforce for Monroe County was 82,600 working age adults (ages 16 to 65) in February of 2024.

Figure 2 - Unemployment Rate Jan. 2014 to Feb. 2024



Source: Pennsylvania Department of Labor & Industry, 2024

Monroe County’s leading industries are accommodation and food service, retail trade, health care and social assistance, and manufacturing. The primary employment providers within Monroe County are displayed below in *Table 4 - Monroe County Top Employers*.

Table 4 - Monroe County Top Employers

Monroe County Top Employers (Excluding State Employers)	
Ranking	Company
1	Federal Government
2	Aventis Pasteur, Inc.
3	Wal-Mart Associates, Inc.
4	Lehigh Valley Pocono Medical Center
5	Pocono Mountain School District
6	CMBK Resort Operations, LLC.
7	Kalahari Resorts & Conventions
8	East Stroudsburg Area School District

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County Top Employers (Excluding State Employers)	
Ranking	Company
9	Saint Luke’s Hospital
10	Stroudsburg Area School District
Source: Pennsylvania Department of Labor & Industry, 2024	

The top employers’ data was obtained through the Pennsylvania Department of Labor and Industry, Center for Workforce Information and Analysis. This data only provided a list of employers, their ranking, and North American Industry Classification System (NAICS) descriptions. *Table 5 – Quarterly Census of Employment and Wages, 2023 Annual Averages in Monroe County* only calls out how many locations per NAICS description and total number of employees.

Table 5 - Quarterly Census of Employment and Wages, 2023 Annual Averages in Monroe County

Quarterly Census of Employment and Wages, 2023 Annual Averages in Monroe County (PA DLI)					
NAICS	Description	Number of Locations	Number of Employees	Employment Percentage	Average Wages
11	Agriculture, Forestry, Fishing, and Hunting	26	187	0.3%	\$26,921.00
21	Mining, Quarrying, and Oil & Gas	7	70	0.1%	\$57,261.00
22	Utilities	11	154	0.3%	\$105,115.00
23	Construction	359	1,900	3.4%	\$56,087.00
31-33	Manufacturing	125	5,031	9.0%	\$90,526.00
42	Wholesale Trade	102	650	1.2%	\$67,344.00
44-45	Retail Trade	576	8,555	15.3%	\$33,033.00
48-49	Transportation and Warehousing	160	3,246	5.8%	\$56,440.00
51	Information	44	295	0.5%	\$58,094.00
52	Finance and Insurance	148	851	1.5%	\$66,927.00
53	Real Estate, Rental, and Leasing	145	525	0.9%	\$46,079.00
54	Professional and Technical Services	320	1,318	2.4%	\$64,765.00
55	Management of Companies and Enterprises	30	174	0.3%	\$151,591.00
56	Administrative and Waste Services	195	1,794	3.2%	\$42,283.00
61	Educational Services	89	4,666	8.4%	\$65,128.00

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Quarterly Census of Employment and Wages, 2023 Annual Averages in Monroe County (PA DLI)					
NAICS	Description	Number of Locations	Number of Employees	Employment Percentage	Average Wages
62	Healthcare and Social Assistance	418	8,773	15.7%	\$61,369.00
71	Arts, Entertainment, and Recreation	80	1,247	2.2%	\$29,712.00
72	Accommodation and Food Services	414	10,289	18.5.3%	\$27,889.00
81	Other Services (Except Public Administration)	345	2,005	3.6%	\$36,765.00
92	Public Administration	51	4,033	7.2%	\$74,369.00
-	Total, All Industries	3645	55764	100%	\$52,410.00
Source: PA, DLI, 2024, NAICS (North American Industry Classification System)					

An effort was made during this hazard mitigation plan update to identify socially vulnerable populations in Monroe County, so that these populations could be given an opportunity to participate in the hazard mitigation planning process. In Monroe County, there are 59,113 total households. Of the total households, 56,028 households have a computer, and 3,085 households have no computer access. 53,667 households in Monroe County have a broadband internet subscription, and 5,446 households have no broadband internet subscription. In the county, 3,589 adults do not have an education higher than a 9th grade level. Homes and households where English is not the primary spoken language or is a secondary language are uniquely vulnerable due to communication challenges. In Monroe County, approximately 4.9% of the households have a language other than English and speak English “less than well.” Unsheltered and unhoused populations in Monroe County are also considered socially vulnerable populations. The steering committee provided information from the Pennsylvania Continuums of Care (PA COC) regarding individuals experiencing homelessness in Monroe County in a Point-in-Time (PIT) Count. This information was collected between Wednesday, January 24th, 2024 and Thursday, January 25th, 2024. According to the report “all emergency shelters, domestic violence shelters, agencies that provide hotel/motel vouchers, transitional housing, rapid re-housing, permanent supportive housing, and other permanent housing programs are required to submit information for the PIT Count” (PA COC, 2024). This information can be found in the table that follows:

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Summary: Households/Persons Counted During the Annual Point-In-Time Count, 2022-2024												
Monroe County												
	Total Persons/Households			Sheltered						Unsheltered		
				Emergency			Transitional					
	2022	2023	2024	2022	2023	2024	2022	2023	2024	2022	2023	2024
All Households & Persons												
Total # Households	96	116	133	71	84	92	19	19	26	6	13	15
Total # Persons	169	175	194	129	124	116	34	36	59	6	15	19
# Children <18 years old	60	44	51	45	27	18	15	17	33	0	0	0
# Young Adults 18-24 years old	5	12	15	5	9	14	0	3	1	0	0	0
# Adults 25+ years old	104	119	128	79	88	84	19	16	25	6	15	19
Households without Children												
# Households	64	92	108	47	68	82	11	11	11	6	13	15
# Persons (Adult)	70	101	116	53	75	86	11	11	11	6	15	19
# Young Adults (18-24)	4	7	12	4	6	12	0	1	0	0	0	0
# Adults (25+)	66	94	104	49	69	74	11	10	11	6	15	19
Households with at least one Adult & one Child												
# Households	32	24	25	24	16	10	8	8	15	0	0	0
# Persons (Adults & Children)	99	74	78	76	49	30	23	25	48	0	0	0
# Children (<18)	60	44	51	45	27	18	15	17	33	0	0	0
# Persons Adults	39	30	27	31	22	12	8	8	15	0	0	0
# Young Adults 18-24 years old	1	5	3	1	3	2	0	2	1	0	0	0
# Adults 25+ years old	38	25	24	30	19	10	8	6	14	0	0	0
Households with only Children (Age 17 or under)												
# Households	0	0	0	0	0	0	0	0	0	0	0	0
# Children (<18)	0	0	0	0	0	0	0	0	0	0	0	0
Unaccompanied Youth Households												
# Unaccompanied Youth Households	2	5	12	2	4	12	0	1	0	0	0	0
# Unaccompanied Youth	2	5	12	2	4	12	0	1	0	0	0	0
# Unaccompanied Youth <18	0	0	0	0	0	0	0	0	0	0	0	0
# Unaccompanied Youth 18-24	2	5	12	2	4	12	0	1	0	0	0	0
Parenting Youth Households												
# Parenting Youth Households	0	4	2	0	2	1	0	2	1	0	0	0
# Persons in Parenting Youth Households	0	9	4	0	5	2	0	4	2	0	0	0
# Parenting Youth (youth parents only)	0	4	2	0	2	1	0	2	1	0	0	0
# Parenting Youth <18	0	0	0	0	0	0	0	0	0	0	0	0
# Parenting Youth 18-24	0	4	2	0	2	1	0	2	1	0	0	0
# Children w/ Parenting Youth (children<18 w/ parents <25)	0	5	2	0	3	1	0	2	1	0	0	0
Chronically Homeless												
# Chronically Homeless Individuals	4	13	13	4	12	9				0	1	4
# Chronically Homeless Families	0	0	0	0	0	0				0	0	0
Other Homeless Subpopulations												
Severely Mentally Ill	15	5	14	12	5	13	3	0	0	0	0	1
Chronic Substance Abuse	0	25	2	0	19	0	0	6	0	0	0	2
Persons with HIV/AIDS	0	1	1	0	0	1	0	1	0	0	0	0
Veterans	14	15	21	4	4	8	10	10	12	0	1	1
Victims of Domestic Violence	31	17	25	31	17	16	0	0	7	0	0	2

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Specific outreach to shelters and locations that assist socially vulnerable populations were conducted during this hazard mitigation planning process.

2.4. Land Use and Development

Monroe County is composed of twenty municipalities, which include:

- Sixteen townships
- Four boroughs

The majority of acreage in Monroe County is forested, while approximately 5.96% (or 23,193 acres) of the acreage is agriculture. The 23,193 acres of farmland in Monroe County can be broken down further by the purpose for which the land is used. Cropland in Monroe County accounts for 46.7% of farmland, pastureland accounts for 3.4%, woodland accounts for 42.1%, and other types of farmland accounts for 7.8%.

Monroe County has approximately 389,120 acres of total land area, and 5,760 acres of water area, with a population per square mile of 276.7 persons based on 2020 data estimates. Forested areas, including deciduous, evergreen, and mixed deciduous and evergreen account for approximately 267,895.1 acres or 68.8%. Wetlands, including emergent and forested wetlands account for 23,096.4 acres of 5.94% of the land area. Together this is 74.8% of the land area in Monroe County. The other 25.2% is made up of agricultural areas and developed areas. The land use in Monroe County, specifically the agricultural land use, can be adversely impacted by hazards discussed and profiled further in this document. Specific discussions on drought impacts related to agricultural areas and products can be found in section 4.3.1.

Development in Monroe County has historically been restricted to centers around the municipalities and population dense areas. This is outlined in the Monroe County 2014 Comprehensive Plan. These areas include Stroudsburg and East Stroudsburg, Mount Pocono, and the areas of Blakeslee and Brodheadsville. Also, the area along the confluence of Interstate 80 and State Route 611 are part of this development area. Industrial development is likely to occur in the future in areas that are considered “business parks”. These locations are evenly distributed around the county and are located along high-volume traffic areas.

Future Development in Monroe County

Areas of Monroe County that could see significant future development include areas where commercial development has already occurred and areas that are highly populated. Specifically in Monroe County, Coolbaugh Township is an area of future development. Coolbaugh Township has the largest population in Monroe County and has significant potential for commercial areas.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

During discussions with municipalities as part of this hazard mitigation plan update, it was determined that there may be an emergency response vulnerability regarding development at the area near the southwestern portion of Pocono Township. If future development occurs in that area, access needs for emergency services should be reviewed and updated. Currently there are only two access roads for emergency services and if traffic prevents one of those from being used, there are concerns about a delay in response. Also, if individuals are being evacuated from that area, there is not enough room for fire apparatus to access those locations because of the width of road shoulders and obstructions along those roads. Many of the subdivisions developed in Monroe County in the 1970's and 1980's were designed only one way into or out of the community, which can cause a concern for emergency service ingress and egress.

During public outreach, community members in Monroe County outlined specific transportation accident concerns. These maps outlined that the community was well engaged with transportation accident discussions and these maps are included as a supplemental appendix to this hazard mitigation plan update. This process is a best practice for public outreach and should be continued in future hazard mitigation planning for the county.

2.5. Data Sources and Limitations

The following data sources were 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 (PA DCNR).
- Pennsylvania Department of Environmental Protection (PA DEP).
- Pennsylvania Department of Labor and Industry (PA DLI).
- Pennsylvania Groundwater Information System (PaGWIS).
- Pennsylvania Emergency Incident Reporting System. (PEIRS)
- Pennsylvania Emergency Management Agency (PEMA).
- Monroe County Comprehensive Plan 2014.

The countywide Digital Flood Insurance Rate Maps (DFIRM) were used for all flood risk analysis and estimation of loss. The Monroe County DFIRMs were approved and effective in 2013. The DFIRM 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

In order to assess the vulnerability of different jurisdictions to the hazards, data on past occurrences of damaging weather events was compiled. A large number of natural-hazard events were gathered from the National Climatic Data Center (NCDC) database. The NCDC is a division of the United States Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by the NCDC from data gathered by the National Weather Service (NWS), another division of NOAA. The data is then presented by the NCDC as tabular data that can be queried in the United States Storm Events database, which "documents the occurrences of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce" (NOAA, 2006). The classification of storm events in the database is based off of data collected from around the United States and the Commonwealth of Pennsylvania, so the data may not be filed under the correct storm category due to user input error. The reason for this data issue results from some storm events falling under multiple categories, including but not limited to winter storm, ice storm, tornado, hurricane / tropical storm, flooding, and flash flooding. Many of the events listed in the United States Storm Events database can fall under multiple of these categories. In an effort to include a comprehensive list of prior storm events for Monroe County, search queries with multiple storm classifications were conducted for each hazard.

Throughout the risk and vulnerability assessment included in Section 4 of this Hazard Mitigation Plan, descriptions of limited data indicate some areas in which the county and the municipalities can improve their ability to identify vulnerable structures and improve loss estimates. As the county and municipal governments work to increase their overall technical capacity and implement comprehensive planning goals, they will also attempt to improve the ability to identify areas of increased vulnerability.

This hazard mitigation plan evaluates the vulnerability of the county's community lifelines. For the purposes of this plan, critical infrastructure facilities are those entities that are essential to the health, welfare, and safety of the community. This includes but is not limited to airports, emergency medical service (EMS) stations, communication facilities and towers, day care centers and preschools, fire departments, hospitals and medical facilities, police departments, schools, and senior living facilities. The locations of these facilities were provided by the Monroe County Planning Commission or developed from research during this planning process.

Community lifeline facilities are described as "fundamental services in the community that, when stabilized, enable all other aspects of society to function" (FEMA, 2025). Also, FEMA states that "When disrupted, decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to stabilize the incident" (FEMA, 2025).

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

FEMA breaks down community lifelines into the following categories that sort daily operations into categories for review (FEMA, 2025):

	Safety and Security - Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
	Food, Hydration, Shelter - Food, Hydration, Shelter, Agriculture
	Health and Medical - Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
	Energy - Power Grid, Fuel
	Communications - Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
	Transportation - Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
	Hazardous Materials - Facilities, HAZMAT, Pollutants, Contaminants
	Water Systems - Potable Water Infrastructure, Wastewater Management

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 foundation of data was available from the Monroe County Planning Commission . Some of the utilized data was downloaded from the Pennsylvania

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Spatial Data Access (PASDA). A large portion of the plan utilizes census data from the United States Census Bureau, but the 2020 census data collection and dissemination was disrupted due to the COVID-19 Pandemic in 2020 and 2021. The 2020 census was delayed, and the information received during the census was spread out due to social distancing and the limiting of census takers going door to door to gather information.

The Monroe County Planning Commission provided the following layers for use in the development of hazard profiles and hazard profile mapping for the 2025 Hazard Mitigation Plan Update:

- Monroe County Fire Departments
- Monroe County Road Centerlines
- Monroe County SARA Sites
- Monroe County Site Structure Address Points
- Monroe County Tier II Facilities

The following GIS Data layers were developed for use in the 2025 Hazard Mitigation Plan Update:

- Monroe County Airports
- Monroe County Boundary
- Monroe County Community Lifelines
- Monroe County Dam Inventory
- Monroe County Electricity Transmission Lines
- Monroe County Electric Substations
- Monroe County Groundwater Withdrawal Points
- Monroe County Historic Streams
- Monroe County Historic Tornado Tracks
- Monroe County Lakes
- Monroe County Levee Areas
- Monroe County Levee Centerlines
- Monroe County Major Roadways
- Monroe County Natural Gas Pipelines
- Monroe County Ponds
- Monroe County Power Plants
- Monroe County Special Flood Hazard Area (SFHA)
- Monroe County Traffic Information
- Monroe County Trails

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- Monroe County Toxic Release Inventory (TRI) Locations
- Monroe County Wildland Urban Interface
- Monroe County Zip Codes

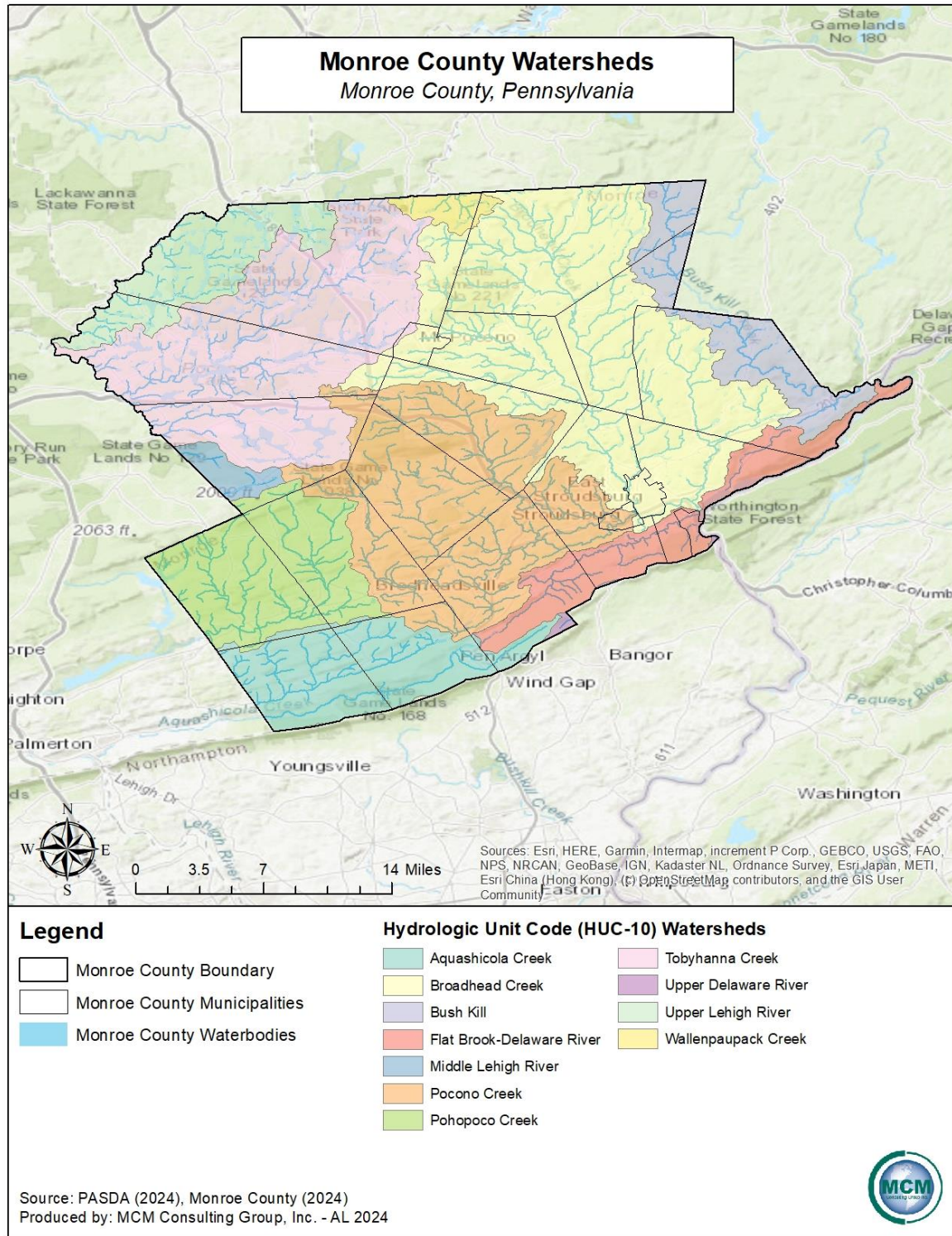
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 3 - Monroe County Basemap



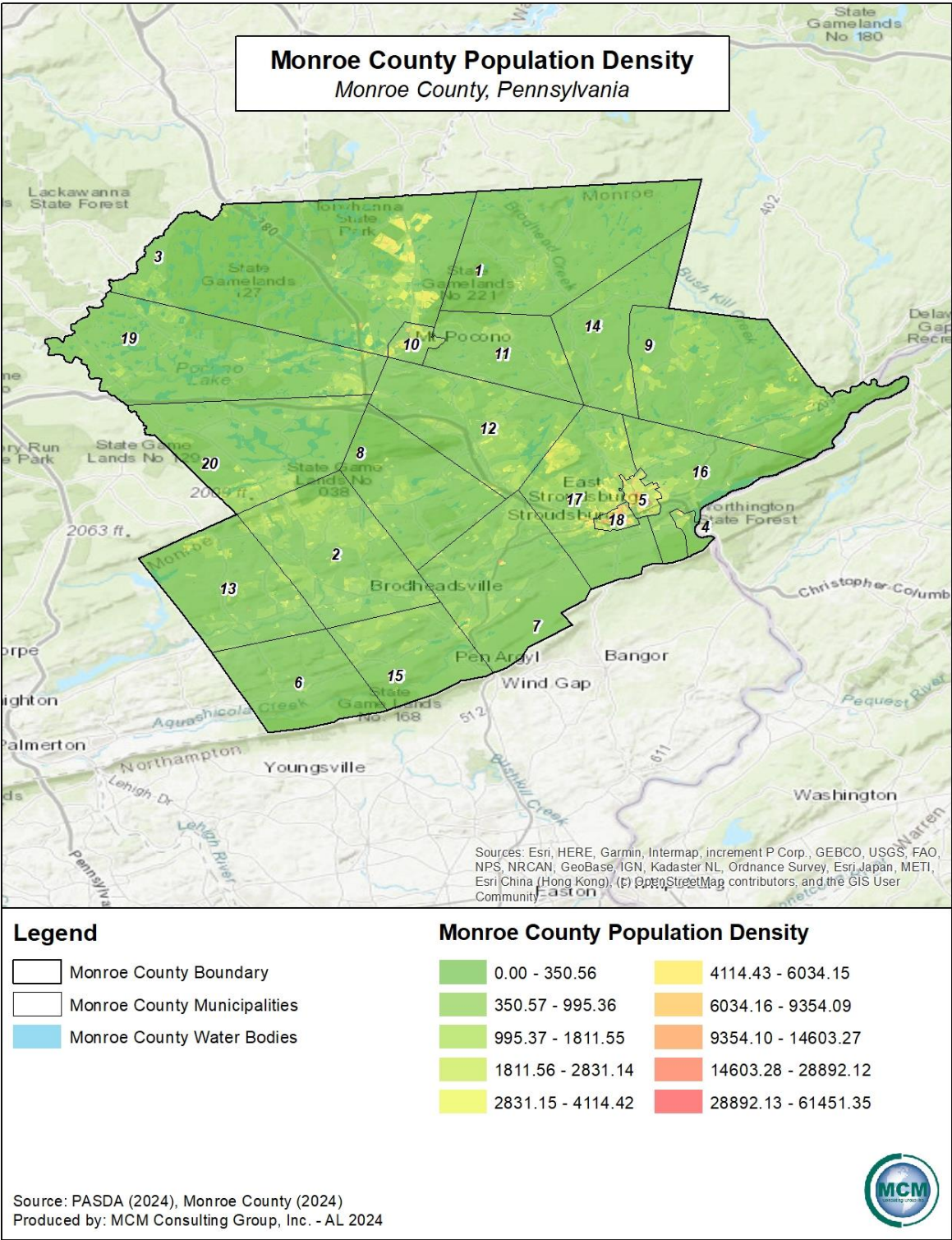
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 4 - Monroe County Watersheds



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 5 - Monroe County Population Density



3. Planning Process

3.1. Update Process and Participation Summary

The Monroe County Hazard Mitigation Plan update began January 3rd, 2024. 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, the 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 Crosswalk, 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 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 update process. Meetings were held both virtually and in-person. This was done to maximize the overall planning process and participation and to assist with scheduling and the convenience of participating virtually when in-person attendance was not possible.. 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. 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

portions of the capability's 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 municipal and county websites and social media platforms.
- Involving elected and appointed county and municipal officials in a series of meetings, training sessions, and workshops.
- 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 releases and postings on the municipal and county websites and social media platforms.
- Plan adoption at a public meeting of the Monroe County Board of Commissioners.
- Plan submission to FEMA and PEMA.

The 2025 Monroe County HMP was completed on February 26th, 2025. The 2025 plan follows an outline developed by PEMA, which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. The 2025 HMP format is consistent with the PEMA recommended format. The 2025 Monroe County HMP combined dam failure and levee failure profiles; and has added additional hazard profiles to the HMP, and these additional profiles increased the subsections in section 4.3 of the HMP.

3.2. The Planning Team

The 2025 Monroe County Hazard Mitigation Plan update was led by the Monroe County Steering Committee. The Monroe County Steering Committee provided guidance and leadership for the overall project. The steering committee assisted MCM Consulting Group, Inc. with dissemination of information and administrative tasks. *Table 6 – Steering Committee* outlines the individuals that comprised this team.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 6 - Steering Committee

Monroe County Hazard Mitigation Plan Update Steering Committee		
Name	Organization	Position
Maryellen Keegan	Monroe County Office of Emergency Management	Director
Christine Meinhart-Fritz	Monroe County Planning Commission	Director
Samantha Rispoli	Monroe County Office of Emergency Management	Emergency Preparedness Planner
Julia Sherer	Monroe County Planning Commission	Senior Environmental Planner
Michael Rearick	MCM Consulting Group, Inc.	Director of Operations
Timothy Baldwin	MCM Consulting Group, Inc.	Director of Technology
Valerie Zents	MCM Consulting Group, Inc.	Senior Consultant
Adam Leister	MCM Consulting Group, Inc.	Senior GIS Consultant
Daniel Becker	MCM Consulting Group, Inc.	Consultant
Ashley Day	MCM Consulting Group, Inc.	Project Coordinator
Alyssa Rusnock	MCM Consulting Group, Inc.	Project Coordinator

In order to represent the county, the Monroe County Steering Committee developed a diversified list of potential local planning team (LPT) members. Members that participated in the 2021 hazard mitigation plan were highly encouraged to join the 2025 team. The steering committee then provided invitations to the prospective members and provided a description of duties to serve on the LPT. The invitations for members of the LPT were disseminated by the Monroe County Office of Emergency Management utilizing letters, email, and telephone calls. These invitations included local and regional agencies involved in HMP activities, agencies with the authority to regulate development, neighboring communities, businesses and academia, and representatives for county offices and agencies involved in reaching out to socially vulnerable populations. The LPT worked throughout the process to plan and hold meetings, collect information, and conduct public outreach.

The stakeholders listed in *Table 7 – Local Planning Team* served on the 2025 Monroe County Hazard Mitigation Local Planning Team, actively participated in the planning process by

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

attending meetings, completing assessments, surveys, and worksheets and/or submitting comments. All potential local planning team members were presented with an email invitation prior to the local planning team kickoff meeting on January 8th, 2024. That invitation information for the local planning team is included in Appendix C – Support Documentation of this hazard mitigation plan update.

Individuals representing local interests in dams were presented with the opportunity to participate in the local planning team. Emails were sent to officials involved in the ownership of dams.

During the planning process the Monroe County Steering Committee include representatives for socially vulnerable, underserved, and unserved populations throughout the planning period. Increased participation for representatives for socially vulnerable and unserved populations in Monroe County is a goal for the next planning period, and mitigation actions can be found in section 6.4. The Monroe County Steering Committee utilized the following definition from FEMA to guide the discussion for socially vulnerable populations: “Persons who may have additional needs before, during, and after an incident in functional areas, including but not limited to: maintaining independence, communication, transportation, supervision, and medical care. Individuals in need of additional response assistance may include those who have disabilities; live in institutionalized settings; are senior; are children; are from diverse culture; have limited English proficiency or are non-English speaking; or are transportation disadvantaged.” Throughout the planning process, the Monroe County Steering Committee and Local Planning Team continually liaised with representatives for the socially vulnerable communities in Monroe County and held individual meetings for those representatives to discuss hazard mitigation, impacts on their communities, and specific mitigation efforts. Those meetings can be found outlined in *Table 8 - HMP Process Timeline*.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 7 - Local Planning Team

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
Scott Ahner	Tobyhanna Army Depot	Emergency Management
David Albright	Chestnuthill Township	Township Manager
Sharon Antal	Pennsylvania Association of the Deaf	Representative
Mehmet Barzev	Stroudsburg Borough	Emergency Management Coordinator
Bob Bashore	Tunkhannock Township	Emergency Management Coordinator
Garrett Beers	DCNR Bureau of Forestry	Fire Forester
Jerrold Belvin	Pocono Township	Emergency Management Coordinator/Township Manager
Nathan Black	East Stroudsburg University	Director, EHS
Chris Borger	Brodhead Creek Regional Authority	Operations Manager
Melissa Brown	Safe Monroe	Volunteer Coordinator
Victor Brozusky	East Stroudsburg Borough	Mayor
Robert Bryant	Northampton Community College	Director of Operations
Kristine Bush	PA 40 th Senate District	District Director
Lawrence Buzzard	Hamilton Township	Township Supervisor
Shawn Campanaro	PennDOT 5-0	District Maintenance Manager
John Christy	Monroe County Commissioners	Commissioner
Patricia Clancy	Monroe County Information Technology	Chief Information Officer

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
William Clark	Hamilton Township	Emergency Management Coordinator
Tyler Corbett	Stroud Township	Emergency Management Coordinator
Brandon Cortazar	Pennsylvania State Police	Corporal
Tulsi Crowell	Northbound and Co.	Community Liaison
Steve Davidheiser	Pennsylvania American Water	Senior Project Manager - Dams
Lee Dillon	Tobyhanna State Park	Park Manager
Marissa Duffy	Mt Pocono Borough	Borough Manager
Bill Edinger	Monroe County Office of Emergency Management	Deputy Director
Keith Elliott	Jackson Township	Emergency Management Coordinator
Kristi English	Pennsylvania American Water	Source Water Protection Lead
Dan Frable	St. Luke's - Monroe	Manager/Security
Howard Gonk	Local Dam Owner	Local Dam Owner
Rich Gannon	Mt Pocono Borough and Paradise Township	Emergency Management Coordinator
Daryl Gebhardt	Tobyhanna Army Depot	Fire Chief
Larry Gebo	Monroe County Transit Authority	Maintenance
Robert Gilmore	New Perspectives	Community Program Manager
Kate Gregory	Northbound and Co.	Co-Founder
Nic Goebeler	US DHS, Cybersecurity and Infrastructure Security Agency	Security Advisor

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
Martin Gonzalez	Monroe County Amateur Radio Emergency Service and Radio Amateur Civil Emergency Service	Radio Officer
Peter Gonze	Paradise Township	Supervisor
Bill Gouger	East Stroudsburg School District	SPO/SRO
Bob Gress	Monroe County Transit Authority	HR and Safety
Nicole Guogs	Tobyhanna Township Bureau of Fire – Station 44	Treasurer
Thomas Guth, Jr.	Northampton County Emergency Management	Hazard Mitigation/Disaster Recovery Manager
Bobbi Halterman	Monroe County Assessment	Senior Mapper
Kristina Heaney	Monroe County Conservation District	District Manager
Robert Heil	Hamilton Township	Supervisor
Julia Heilakka	Smithfield Township	Emergency Management Coordinator
Rachel Heller	Middle Smithfield Township	Emergency Management Coordinator
Rachel Hendricks	Pocono Mountains Industrial Park Authority	Economic Development Specialist
Tracy Herman	Polk Township	Emergency Management Coordinator
Seth Hoch	American Red Cross	Program Manager
Gary Hoffman	Eldred Township/Monroe County Control Center	Emergency Management Coordinator/Director of Communications
David Hooker	Monroe County Conservation District	Resource Conservation Specialist
David Horacek	Jackson Township	Assistant Roadmaster

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
David Horton	Brodhead Creek Regional Authority	Manager
Josh Houck	Lehigh Valley Health Network	Office of Emergency Management
Peter Huf	Tobyhanna Township	Emergency Management Coordinator
Lisa Kaye	Monroe County Veterans Affairs	Director
Tomas Keane	Coolbaugh Township	Zoning
Maryellen Keegan	Monroe County Office of Emergency Management	Director
Charles Kelshaw	Monroe County Conservation District	Watershed Specialist
Tina Kernan	Tunkhannock Township	Township Manager
Thomas Kitts	East Stroudsburg Borough	Code Enforcement
Jonathan Klotz	Mt Pocono Municipal Authority	Executive Director
Larry Kopp	Stroudsburg Borough	Borough Manager
Alvin Kresge	Camelback Resort	Medic and Emergency Manager
Don Kresge	Jackson Township	Road Master
Sharon Laverdure	Monroe County Commissioners	Commissioner
Thea Lind	MetEd	External Affairs
Kim Lippincott	Monroe County District Attorney	Detective
David Luckykanish	Monroe County Conservation District	Resource Conservation Specialist
Drew Lutton	Pleasant Valley Manor	Administrator

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
Cory Lyon	Middle Smithfield Township	Road Master
Jennifer Lyon	Stroud Area Regional Police Department	Chief
Erin Masker	Coolbaugh Township	Administrator
Kevin Matthews	PennDOT 5-0	District Manager
Matthew McSwegan	Monroe County Information Technology	Deputy Chief Information Officer
Mary Claire Megargle	Monroe County Area Agency on Aging	Administrator
Christine Meinhardt-Fritz	Monroe County Planning Commission	Director
Frederick Mill	East Stroudsburg Areas School District	Safety and Security Officer
Guy Miller	Monroe County LEPC	Finance Secretary
Jim Miller		
James Moser	Whitestone Care Center	Maintenance
Richard Mosher	Price Township	Secretary/Treasurer
Matthew Neeb	Jackson Township/Chestnuthill Planning	Supervisor/Director
Patti O'Keefe	Barrett Township	Supervisor
Dave Parker	Monroe County Commissioners	Commissioner
Dennis Peters	Stroudsburg Borough	Engineer
Lee Philips	East Stroudsburg Borough	Public Work Director
Ryan Poust	Monroe County Planning Commission	GIS Analyst

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
Nick Puccio	Monroe County Amateur Radio Emergency Service and Radio Amateur Civil Emergency Service	Assistant Emergency Coordinator
Steve Rinker	Monroe County Assessment	GIS Coordinator
Samantha Rispoli	Monroe County Office of Emergency Management	Emergency Preparedness Planner
Elizabeth Robison	Pocono Mountain School District	Superintendent
Angela Romano-Lucky	Resources for Human Development	Director
Jeremy Sawicki	Pocono Mountain School District	Director of Technology Services & School Safety
Jeremie Schuster	Monroe County Planning Commission	GIS Analyst
Philip Selleck	Hallowood Acres Homeowners Association	Boardman
Jennifer Shukaitis	Stroud Township	President/Chairperson
David Silliman	Blue Ridge Communications	Resident Manager - Stroudsburg East and West
Dave Shay	Ross Township	Supervisor
Julia Sherer	Monroe County Planning Commission	Senior Environmental Planner
Precie Shroyer	Northampton Community College	Executive Dean
David Silliman	Blue Ridge Communications	Resident Manager – Stroudsburg East and West
Kwanza Smith	Monroe County Fiscal	Grant Manager
James Stout	Colonial Intermediate Unit 21	School Safety and Security Coordinator
Rebecca Tippet	Polk Township	Deputy Emergency Management Coordinator
Tina Transue	Paradise Township	Executive Secretary

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Mitigation Plan Local Planning Team		
Name	Organization	Position
Jonathan Ulanoski	Pennsylvania Department of Emergency Management	Energy Program Specialist
Matthew Unger	Camp Canadensis	Director of Operations
Chris Wagner	Pocono Mountain Regional Police Department	Chief
Patrick Ward	Tobyhanna Army Depot Fire	Assistant Fire Chief
Carrie Weitz	Tunkhannock Township	Emergency Management Coordinator
David Williams	PEMA Eastern Area	Emergency Management Specialist/Planner
Dave Wood	US DHS, Cybersecurity and Infrastructure Security Agency	Protective Security Advisor
Nicole Grous	Tobyhanna Bureau of Fire	
Wendy Frable	Pocono Mountain School District	Director of Public Relations & Safety Compliance

3.3. Meetings and Documentation

Meetings with local elected officials and the local planning team were held, as needed. 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 8 – 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 April 3rd, 2025. The draft was advertised on Monroe County’s social media page and was made available digitally on the Monroe County website at:

<https://www.monroecountypa.gov/departments/office-of-emergency-management/resources/hazard-mitigation>

The public comment period remained open until May 3rd, 2025. All public comments were submitted via an online survey or in writing to the Monroe County Office of Emergency

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Management. Public commenting was available during the public comment period via a Survey Monkey link that was advertised on the county website and social media pages. No public comments were received for this planning period, so no comments are included in Appendix C of this hazard mitigation plan update.

Table 8 - HMP Process Timeline

Monroe County HMP Process Timeline		
Date	Meeting	Description
01/03/2024	Monroe County Hazard Mitigation Steering Committee Kickoff Meeting	Meeting was used to determine individuals to invite to the local planning team and to review the draft project schedule.
01/08/2024	Monroe County Local Planning Team – Kickoff Meeting	Meeting was used to review the project schedule and discuss roles and responsibilities for the hazard mitigation plan. Initial worksheets were introduced and reviewed (hazard identification, capability assessments, project opportunities, and NFIP survey).
01/08/2024	Municipality – Kickoff Meetings	Meeting was used to review the project schedule and discuss roles and responsibilities for the hazard mitigation plan at the municipal level. Initial worksheets were introduced and reviewed (hazard identification, capability assessments, project opportunities, and NFIP survey).
03/11/2024	Monroe County Local Planning Team – Risk Assessment	Meeting was used to discuss the results of the initial documentation request for the municipalities. Selection of hazards for the 2025 hazard mitigation plan was conducted. Risk factor scores were also updated based on changing conditions in Monroe County since the previous planning period.
06/12/2024	Monroe County Local Planning Team – Capability Assessment	Meeting was used to discuss the specifics of the capability assessment portions of the Monroe County plan. This meeting was also used to retrieve information for the future Pre-Disaster Recovery Plan.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Monroe County HMP Process Timeline		
Date	Meeting	Description
09/04/2024	Monroe County Socially Vulnerable Population Meeting	Meeting was used as a workshop and discussion for the socially vulnerable populations in Monroe County. Items covered at this meeting included hazard impacts and specific community vulnerabilities.
09/04/2024	Monroe County Local Planning Team – Mitigation Strategy	Meeting was used to review the 2021 goals and objectives, mitigation actions, and mitigation project opportunities.
10/09/2024	Monroe County Local Planning Team – Continued Mitigation Strategy	Meeting was used to discuss the 2025 mitigation goals, objectives, and actions. Mitigation action development was the primary focus.
10//09/2024	Municipality – Mitigation Form Development	Meeting was used to discuss the project opportunities and needed documentation for the municipalities.
10/09/2024	Public Meeting – Risk Assessment Review	The risk assessment section of the 2025 hazard mitigation plan was reviewed with the public.
11/13/2024	Monroe County Local Planning Team – Continued Mitigation Strategy	Meeting was used to continue discussion on 2025 mitigation action plan and review any remaining items for the mitigation strategy process.
01/15/2025	Monroe County Socially Vulnerable Population Meeting	Meeting was used as a workshop and discussion for the socially vulnerable populations in Monroe County. Items covered at this meeting included mitigation actions and projects.
01/15/2025	Monroe County Local Planning Team – Finalized Mitigation Strategy	Meeting was used to finalize the 2025 mitigation actions. This includes the verbiage and relation of the actions to goals and objectives.
02/26/2025	Public Meeting – Presentation – Risk Assessment/Vulnerable Populations	The draft hazard mitigation plan, specifically risk assessment and vulnerable population discussions, was reviewed with the public.
04/03/2025	Public Meeting – Second Draft Plan Presentation	This draft hazard mitigation plan was reviewed with the public.
02/27/2025 – 06/30/2025	Pre-Disaster Recovery Plan Drafting	Drafting of the pre-disaster recovery plan for Monroe County.

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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

newspaper, the Monroe County website, the municipal websites, Monroe County social media pages, and the municipal social media pages and websites. Copies of those advertisements are in Appendix C. Municipalities and other county entities were invited to participate in various meetings and encouraged to review and 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, or 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 2021 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 2025 municipal project opportunity forms are included as well, located in Appendix G.

In an effort to capture public input, the Monroe County LPT held in person meetings and offered online surveys. 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.

As outlined above, the Monroe County steering committee and local planning team solicited information from the public on hazard locations around their communities. Based on this information, Monroe County was able to get direct hazard issues outlined by the public. This information has been integrated into each relevant hazard profile. The maps for this process is found in an additional appendix to this hazard mitigation plan.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 meeting 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 2025 draft hazard mitigation plan. A letter was sent to the emergency management coordinators or emergency service staff in Carbon, Pike, Lackawanna, Luzerne, Northampton, and Wayne counties in Pennsylvania, and Sussex and Warren counties in New Jersey on April 3rd, 2025. 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 9 – Municipality Worksheets, Surveys, and Forms Participation* reflects the municipalities participation by completing worksheets, surveys, and forms.

Table 9 - Municipality Worksheets, Surveys, and Forms Participation

Monroe County HMP Worksheets, Surveys, and Forms Participation						
Municipality	Capability Assessment Survey	Risk Assessment Hazard Identification and Risk Evaluation Worksheet	NFIP	Risk Factor	Hazard Mitigation Opportunity Form Updates	Hazard Mitigation Opportunity Form Reviews
Barrett Township	X	X	X	X	7	X
Chestnuthill Township	X	X	X		6	N/A
Coolbaugh Township	X	X	X	X	8	X
Delaware Water Gap Borough	X	X	X			N/A
East Stroudsburg Borough	X	X	X	X	4	X
Eldred Township	X	X	X	X - incomplete	3	X
Hamilton Township	X	X	X	X	5	X
Jackson Township	X - incomplete	X	X	X	5	X
Middle Smithfield Township	X	X	X	X	9	X
Mount Pocono Borough	X	X	X	X	17	X

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Monroe County HMP Worksheets, Surveys, and Forms Participation						
Municipality	Capability Assessment Survey	Risk Assessment Hazard Identification and Risk Evaluation Worksheet	NFIP	Risk Factor	Hazard Mitigation Opportunity Form Updates	Hazard Mitigation Opportunity Form Reviews
Paradise Township	X	X	X	X	21	X
Pocono Township	X	X	X	X	7	X
Polk Township	X - incomplete	X	X	X	3	X
Price Township		X				N/A
Ross Township	X	X		X	2	N/A
Smithfield Township	X	X	X	X	5	X
Stroud Township	X	X	X	X		INC
Stroudsburg Borough	X	X	X	X	1	N/A
Tobyhanna Township	X	X	X	X	1	N/A
Tunkhannock Township	X	X	X	X	5	X

All twenty municipalities within Monroe County adopted the 2021 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 2025 Monroe County Hazard Mitigation. The desire of the local planning team, also, is for all institutes of higher education in Monroe County to adopt the 2025 Monroe County Hazard Mitigation Plan in alignment with the Pennsylvania State System of Higher Education (PASSHE) regulations.

The table above was completed with the most accurate information available at the time of the writing of this Hazard Mitigation Plan Update. Since the writing of this plan, some of the municipalities listed above have provided information to Monroe County, which updates their participation status.

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 reduce the threats. 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, storm water runoff and other related factors. Therefore, limiting the risk assessment to past events is myopic and inadequate.

The Monroe County Local Planning Team (LPT) reviewed and assessed the change in risk for all natural and human-caused hazards identified in the 2021 hazard mitigation plan. The mitigation planning team then identified hazards that were outlined within the Pennsylvania Hazard Mitigation Plan but not included in the 2021 Monroe County Hazard Mitigation Plan that could

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 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 eighteen hazard profiles 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 10 – Presidential & Gubernatorial Disaster Declaration contains a list of all Presidential and Gubernatorial disaster declarations that have affected Monroe County and its municipalities from 1955 through 2024, according to the Pennsylvania Emergency Management Agency.

Table 10 - Presidential & Gubernatorial Disaster Declarations

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	Hazard Event	Action
August, 1955	Floods / Rains	Presidential Disaster Declaration
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

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	Hazard Event	Action
March, 1993	Blizzard	Presidential Emergency Declaration
January, 1994	Severe winter storms	Presidential Disaster Declaration
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

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	Hazard Event	Action
June, 2013	High winds, thunderstorms, heavy rain, tornado, flooding	Gubernatorial Proclamation of Emergency
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, Monroe County LPT		

4.2.2. Summary of Hazards

The Monroe County LPT was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2025 HMP Update. Following a review of the hazards considered in the 2021 HMP and the standard list of hazards, the local planning team decided that the 2025 plan should identify, profile, and analyze eighteen hazards. These eighteen hazards include a significant number of the hazards profiled in the 2021 plan. The list below contains the 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 2025 HMP update. Hazard profiles are included in Section 4.3 for each of these hazards.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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.

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.

The National Weather Service defines an extreme cold event as “A period of abnormally cold and dangerous temperatures or wind chills that can result in negative impacts to people, animals, and infrastructure” (NWS, 2025).

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

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 10-30 miles across. Potential threats from hurricanes include powerful winds, heavy rainfall, storm surges, coastal and inland

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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, Epidemic, Endemic, and Infectious Disease

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 hit the U.S. each year, with about sixteen hitting 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 waste) 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 federal lands, state forests, 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 activities. 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 or death (after motor vehicle crashes) among children ages 1-14.

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).

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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.

Substance Use Disorder

Substance use disorder occurs when an individual becomes physically dependent on a drug, either legal or illegal. The most likely focal point of substance use disorder relates to opioid addiction, a class of drugs that reduces pain. “Opioid” is used as a broad term and includes opiates, which are drugs naturally extracted from certain types of poppy plants, and narcotics. Substance abuse can lead to overdose, which can be fatal.

Terrorism/Cyberterrorism Incidents

Terrorism is the 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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).

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Natural Hazards not profiled in the 2025 Monroe County Hazard Mitigation Plan:

- **Earthquake:** After discussion and review of the risks associated with earthquake events in Monroe County, the local planning team decided not to include the earthquake hazard profile in this hazard mitigation plan update or risk factor assessment. While minor impacts from earthquakes have the potential to affect Monroe County the frequency and severity of those events were significantly lower compared to the other natural hazards that pose a more immediate and high-profile threat.
- **Radon Exposure:** The Monroe County Local Planning Team and Steering Committee reviewed the impacts and hazards associated with radon exposure within the county. After careful consideration, the radon exposure hazard profile was removed. This was done to focus more significantly on the hazards that have the higher potential to adversely impact life safety and daily operations within Monroe County. Impacts and items for radon exposure have been added to the mitigation action plan in Section 6.4 of this hazard mitigation plan.

4.2.3. Climate Change

Impacts of Climate Change on Identified Hazards

Humans have a direct impact on the climate and the climate directly impacts our society and the lives of all humans on the planet. Historically, human activity such as large scale consumption of fossil fuels and de-forestation has caused atmospheric carbon dioxide concentrations to significantly increase. The Fourth National Climate Assessment, specifically Volume II: Impacts, Risks, and Adaption in the United States, 2018 outlines that “climate change is transforming where and how we live and presents growing challenges to human health and quality of life, the economy, and the natural systems that support us. Risk posed by climate variability and change vary by region and sector and by the vulnerability of people experiencing impacts” (Fourth NCA, Chp. 1: Overview, 2018). 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

an expansion of the suitable climate for mosquitos, potentially increasing the risk of infectious 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. 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 4.3.3). 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 rainfall and dam and levee failures. Similarly, winter storms are expected to become more intense, if possibly less frequent. 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). The amount of rain and precipitation is also estimated to increase based on estimates from the National Climate Assessment completed in 2018 (Fourth NCA, Chp. 18: Northeast, 2018).

The Fourth National Climate Assessment outlines via the Overview chapter and the chapter on the Northeast specifically, that the impacts from climate change in the Northeast will be related to water production and processing, energy, and transportation. These areas will see an impact from snow, storms, drought, heat waves, and flooding (Fourth NCA, Chp. 1: Overview, Chp.18: Northeast, 2018).

Climate change is contributing to the introduction of new invasive species (Section 4.3.5). 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

intensification of the hazards mentioned above, especially if human society and individuals do not make swift and significant changes combat species losses.

Where applicable, climate change will be discussed for each hazard profile in this hazard mitigation plan. All natural hazards will have a discussion on climate change vulnerability, while certain human-caused hazards may not experience significant vulnerabilities from climate change adaptation and will not have direct narrative addressing those impacts.

Climate change was also taken into account when capabilities were being reviewed, and mitigation actions were being developed and updated.

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 experience drought conditions intermittently throughout the calendar year. 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 droughts:

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.

Droughts are often the leading contributing factor to wildfires, as they leave areas with little to no moisture.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.1.2 Range of Magnitude

The average annual precipitation of 50.22 inches occurs primarily during the spring and summer months. This value is derived from averaging ten years of mean annual precipitation data for Monroe County. Rural farming areas of Monroe County are most at risk when a drought occurs. A drought can create a significant financial burden for the community. Approximately 98% of Monroe County farms are family-owned and operated. Additionally, 46.7% of the county farmland use is devoted to crop cultivation, 42.1% of farmland is woodland, 3.4% is pastureland, and 7.8% is for other purposes. Wildfires are often the most severe secondary effect associated with drought. Wildfires can devastate wooded and agricultural areas, structures near high wildfire loads, and farm production facilities, and threaten natural resources. 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.

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.

Local municipalities may, with the approval of the Pennsylvania Emergency Management Council, implement local water rationing. 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 mandatory water usage restrictions imposed by the Commonwealth and/or local municipalities, procedures are provided for granting of variances to consider individual hardships and economic dislocations. *Table 11 – Drought Preparation Phases* shows the FEMA-defined levels of drought severity along with suggested actions, requests, and goals.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 11 - Drought Preparation Phases

Drought Preparation Phases				
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.	Reduced water use by 15%.
Source: Pennsylvania Department of Environmental Protection, 2017				

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 records)
- Soil moisture via the Palmer Drought Index as seen in *Table 12 – Palmer Drought Severity Index*, which is a soil moisture algorithm calibrated for relatively homogenous regions which measures dryness based on recent precipitation and temperature.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 12 - Palmer Drought Severity Index

Palmer Drought Severity Index (PDSI)	
Severity Category	PDSI Value
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

The effects of a drought can be far-reaching both economically and environmentally. Economic impacts include 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: *Table 13 – Economic and Environmental Impacts of Drought Events* qualifies the potential economic and environmental impacts from a drought event.

Table 13 - Economic and Environmental Impacts of Drought Events

Economic and Environmental Impacts of Drought Events	
Economic	Environmental
<ul style="list-style-type: none">- Reduced productivity of aquatic resources- Mandatory water use restrictions- Well failures- Cutbacks in industrial production- Agricultural losses- Limited recreational opportunities	<ul style="list-style-type: none">- Hydrologic effects- Adverse effects on animal populations- Damage to plant communities- Increased number and severity of fires- Reduced soil quality- Air quality effects- Loss of quality in landscape

4.3.1.3 Past Occurrence

The Pennsylvania 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”

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

section above. The declared drought status from 1980 to 2023 is shown in *Table 14 – Past Drought Events in Monroe County*.

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 as seen in *Figure 15 – Monroe County Palmer Drought Severity Index 1895-1995*.

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 Thomas Ridge to declare a drought emergency in fifty-five counties. During this event, precipitation deficits for that summer averaged five to seven inches below normal; the Susquehanna River hit record low flows, streams were dry, and many wells were depleted. Crop damage losses totaled over \$500 million statewide, and those losses equated to 70% to 100% of crop production. There were additional losses from the decline of milk production. Also, the state asked municipal and private water suppliers to restrict local water use.

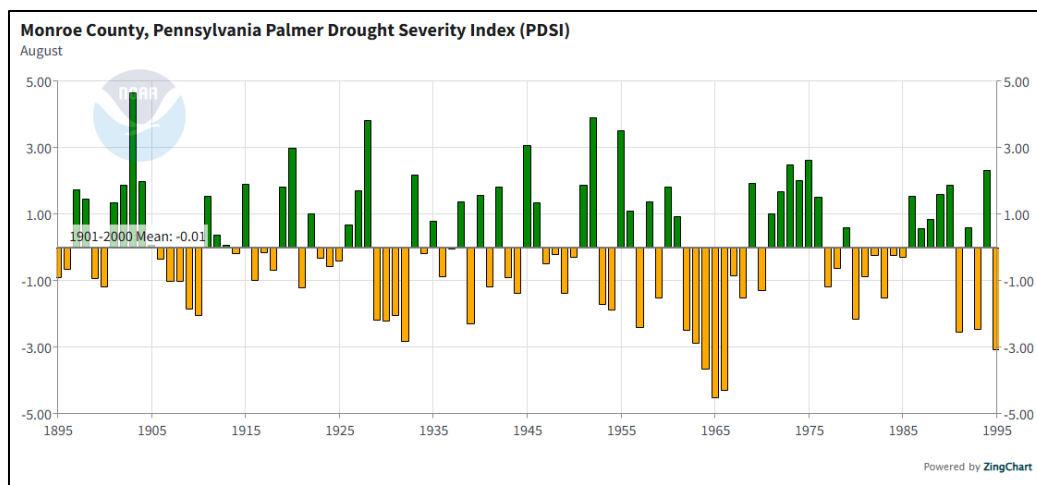
Table 14 - Past Drought Events in Monroe County

Past Drought Events in Monroe County			
Start Date	End Date	Drought Status	Event Duration (Days)
11/18/1980	04/20/1982	Emergency	518
11/10/1982	02/08/1983	Warning	90
02/08/1983	03/28/1983	Warning	49
01/23/1985	04/26/1985	Warning	93
04/26/1985	12/19/1985	Emergency	237
07/07/1988	12/12/1988	Watch	158
03/03/1989	05/15/1989	Warning	73
07/24/1991	04/20/1992	Emergency	271
04/20/1992	06/23/1992	Warning	64
09/01/1995	09/20/1995	Warning	19
09/20/1995	12/18/1995	Emergency	89
10/27/1997	01/16/1998	Warning	81
12/03/1998	12/14/1998	Watch	11
07/20/1999	09/30/1999	Emergency	72
09/30/1999	12/05/2001	Watch	797
12/05/2001	02/12/2002	Warning	69
02/12/2002	05/13/2002	Emergency	90
05/13/2002	11/07/2002	Watch	178
04/11/2006	06/30/2006	Watch	80
08/08/2007	01/11/2008	Watch	156
09/16/2010	11/10/2010	Warning	55
03/24/2015	07/10/2015	Watch	108

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

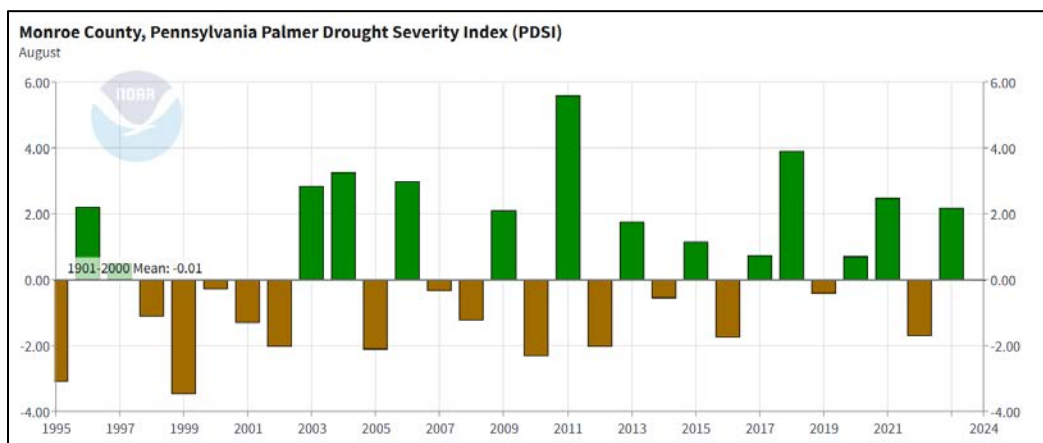
Past Drought Events in Monroe County			
Start Date	End Date	Drought Status	Event Duration (Days)
11/03/2016	02/14/2017	Warning	103
02/14/2017	04/06/2017	Watch	51
08/31/2022	10/17/2022	Watch	47
06/15/2023	08/24/2023	Watch	70
Source: Pennsylvania Department of Environmental Protection, 2023			
**Gubernatorial Disaster Declaration			

Table 15 - Monroe County Palmer Drought Severity Index 1895-1995



The warmest July on record in Pennsylvania occurred in 2020, and sixteen counties entered Drought Watch status on August 21 of that year. In June 2021, dry conditions were again affecting the Commonwealth.

An additional chart, outlining the calendar years 1995 to 2025, has been added below.



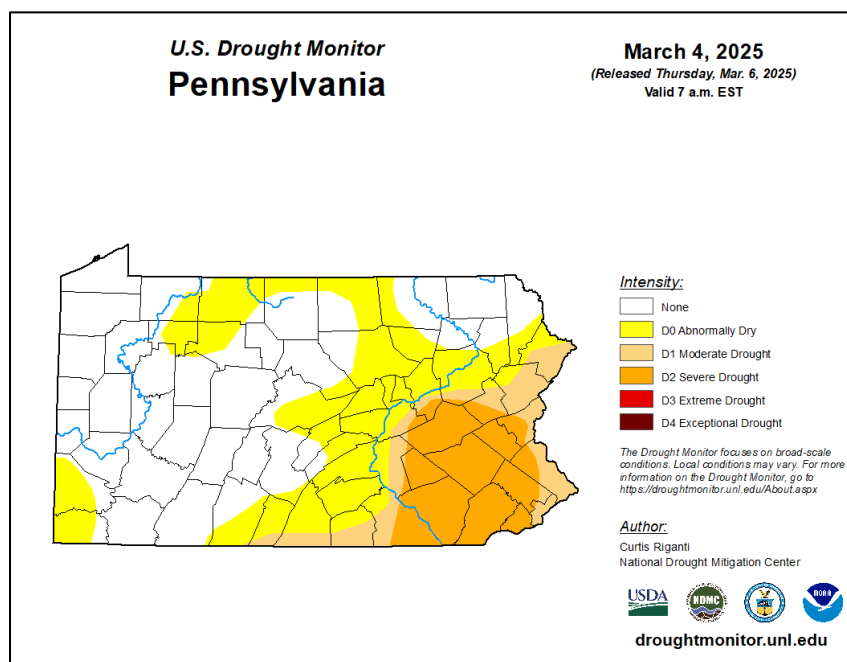
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.1.4 Future Occurrence

It is difficult to forecast the exact severity and frequency of future drought events. Climate change will lead to increased uncertainty and extremity of climate events. Monroe County has experienced severe drought between 5% to 10% of the time between 1895 and 1995 as seen in *Figure 15 – Monroe County Palmer Drought Severity Index 1895-1995*. This 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.

Figure 7 – Current Drought Index for Pennsylvania below shows that Monroe County is currently in abnormally dry or moderate drought conditions as of March 4, 2025.

Figure 7 - Current Drought Index for Pennsylvania



The potential for a drought to occur in Monroe County is 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.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

As stated above, trends indicate climate change will influence the frequency of droughts in the future. As global temperatures rise, weather patterns will change, increasing the number of dry days an area experiences. This could result in more drought periods for a local or regional area. Droughts could also become longer in duration, compared to previous patterns.

4.3.1.5 Vulnerability Assessment

The magnitude of 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 height of the summer growing season.

Land use and major development is a factor that has the potential to impact the vulnerability of drought in Monroe County. Land use, especially agricultural land use, can exacerbate dry conditions, and these agricultural areas can be damaged by drought. There are 23,193 acres of farmland in Monroe County. If the number of agricultural acres increases, that increases the potential vulnerability for drought impacts. Conversely, if the agricultural acres decrease, the potential vulnerability of agriculture to drought decreases. Drought can also have an adverse effect on forested areas. Approximately 79% of land use in Monroe County is forest areas, and it is in these locations that streams and drinking water resources of Monroe County are located according to the *Plan for Clean Water Monroe County, PA*. There are also eight state game lands and two state forest districts that make up a large portion of the county. Long periods of drought can increase the potential for wildfires and invasive species that could damage these forested areas. Economic benefits through the provision of wood products would also be affected.

There are many hazards that can be considered cascading hazards related to drought events. Wildfire is the most severe cascading hazard effect associated with drought. Wildfires can devastate wooded and agricultural areas, threatening natural resources and farm production facilities. With drought events, water infiltration into the ground becomes more difficult. This lack of infiltration can result in flash flooding events in areas of steep slopes, canyons, and rolling hills. A loss of vegetation from a drought can also increase the occurrence of landslides in areas of steep slopes with loose packed soil profiles. A discussion on the county's vulnerability to wildfire and flash floods can be found in Section 4.3.8.5 and 4.3.3.5 respectively.

Droughts can have adverse effects on farms and other water-dependent industries resulting in local economic loss. Areas of extensive agriculture use are particularly vulnerable to drought;

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

23,193 acres of Monroe County, or roughly 5.96% of the 389,376 total land acreage, make up farmland (United States Department of Agriculture [USDA], 2022 Census). The total number of farms for Monroe County is 245 and the average acreage for farms in Monroe County is ninety-five acres. Agricultural production from crops, including nursery and greenhouse crops, accounts for more than \$7.9 million in commerce annually. Production from livestock, poultry, and their products accounts for \$4.8 million annually. The livestock that has the greatest potential to be impacted are the broilers and other meat-type chickens and poultry layers. There are approximately 4,000 broilers and other meat-type chickens and 2,200 poultry layers in Monroe County. Acreage for farming has decreased since the 2017 USDA Census when there was a reported total of 27,607 farming and drought vulnerable acres.

Monroe County also has 20,238 domestic wells and nine irrigation wells that would be adversely impacted by drought events. This impact would lead to lower water levels for at least 20,238 households and potentially nine large farms. This well information was obtained by using the PA GEOCODE application to find well information for the entirety of Monroe County, with data that is not part of Monroe County or from neighboring municipalities removed.

Droughts can have a severe impact on water resources, utilities, and conservation within Monroe County. As discussed, droughts can lower water available for emergency services, everyday use, and agriculture. Droughts can cause issues for water treatment plant and wastewater treatment plant operations throughout a regional area. During a declared drought event, the county or individual municipalities may issue water conservation measures to ensure critical operations are able to continue uninterrupted.

Additionally, emergency services can be adversely impacted by drought as a cascading hazard. Local fire departments often utilize ponds, creeks, and streams for water onboard fire apparatus. With low water levels in waterbodies, responders may be unable to draft enough water to efficiently respond to and extinguish a fire. Also, with an increased number of potential wildfires due to drought conditions, agencies may not have the personnel to efficiently respond to all fires in a timely manner.

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

All properties in Monroe County that are part of the National Register of Historic Places have the same vulnerability to drought. No one property has a greater risk than the others, but each of the historic and cultural properties is vulnerable at some level.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Municipalities with high risk due to drought:

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Delaware Water Gap Borough
- East Stroudsburg Borough
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Mount Pocono Borough
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Rosss Township
- Smithfield Township
- Stroud Township
- Stroudsburg Borough
- Tobyhanna Township
- Tunkhannock Township

Populations in Monroe County, including the socially vulnerable, underserved, and unserved populations, are at different levels of vulnerability. The socially vulnerable have an increased risk due to the unsheltered or homeless not having access to reliable sources of water. Also, those individuals who are considered socially vulnerable because of location in rural areas are also at an increased risk because of agricultural and well status.

As seen in *Table 3 – Population Change in Monroe County*, thirteen of the twenty municipalities in Monroe County have experienced a population loss since the 2010 decennial census. Nine municipalities have seen a net population increase from the 2010 decennial census to the 2020 decennial census. Based on this information, it can be speculated that these nine municipalities may have an increased risk to drought conditions, since 2010, due to the increase in population.

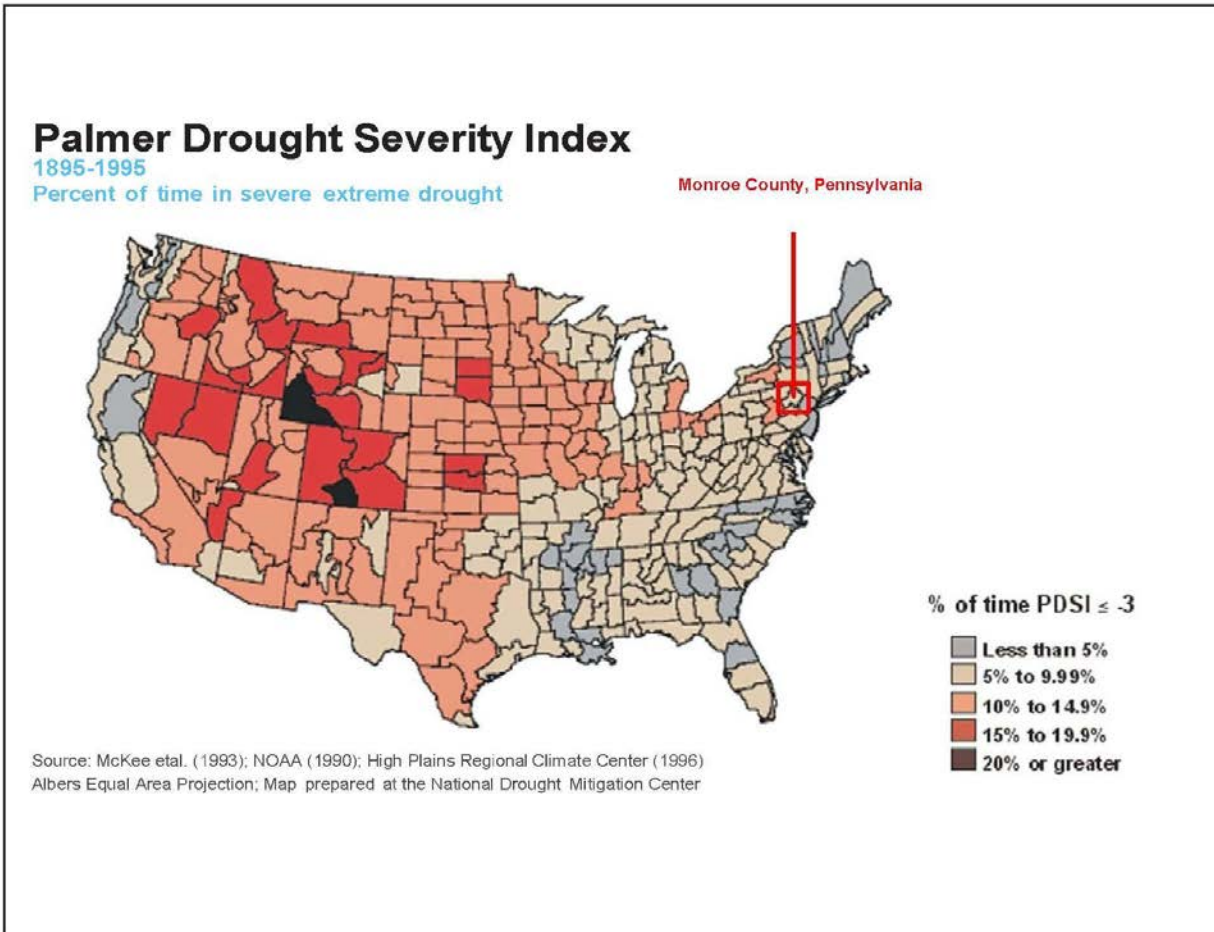
Drought also has the potential to impact historic and cultural resources in Monroe County. Monroe County has twenty-two historic or cultural properties or buildings, and drought could impact utility delivery to those locations. These properties are the Cool Spring Farm

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Springhouse, East Stroudsburg Armory, East Stroudsburg Railroad Station, John Michael Farm, Schoonover Mountain House, John Turn Farm, and the Zion Lutheran Church. Drought events in Monroe County can impact certain systems and community lifelines that are tied into the historic or cultural properties. Water utilities can be directly impacted by drought events when prolonged dry weather lowers the available water in reservoirs and water systems used by a county or a community. Drought could impact electric utilities if moving water is used in electric generation. When water is used for electric generation, drought events could cause lower utilization and efficiency. This is more common in the western United States, but it could occur if any counties in Pennsylvania utilize water for power generation. Currently, Monroe County does not use waterpower for electric generation. Other systems that could potentially be impacted by a drought event are wastewater utilities and any nuclear power generation that uses water in its process.

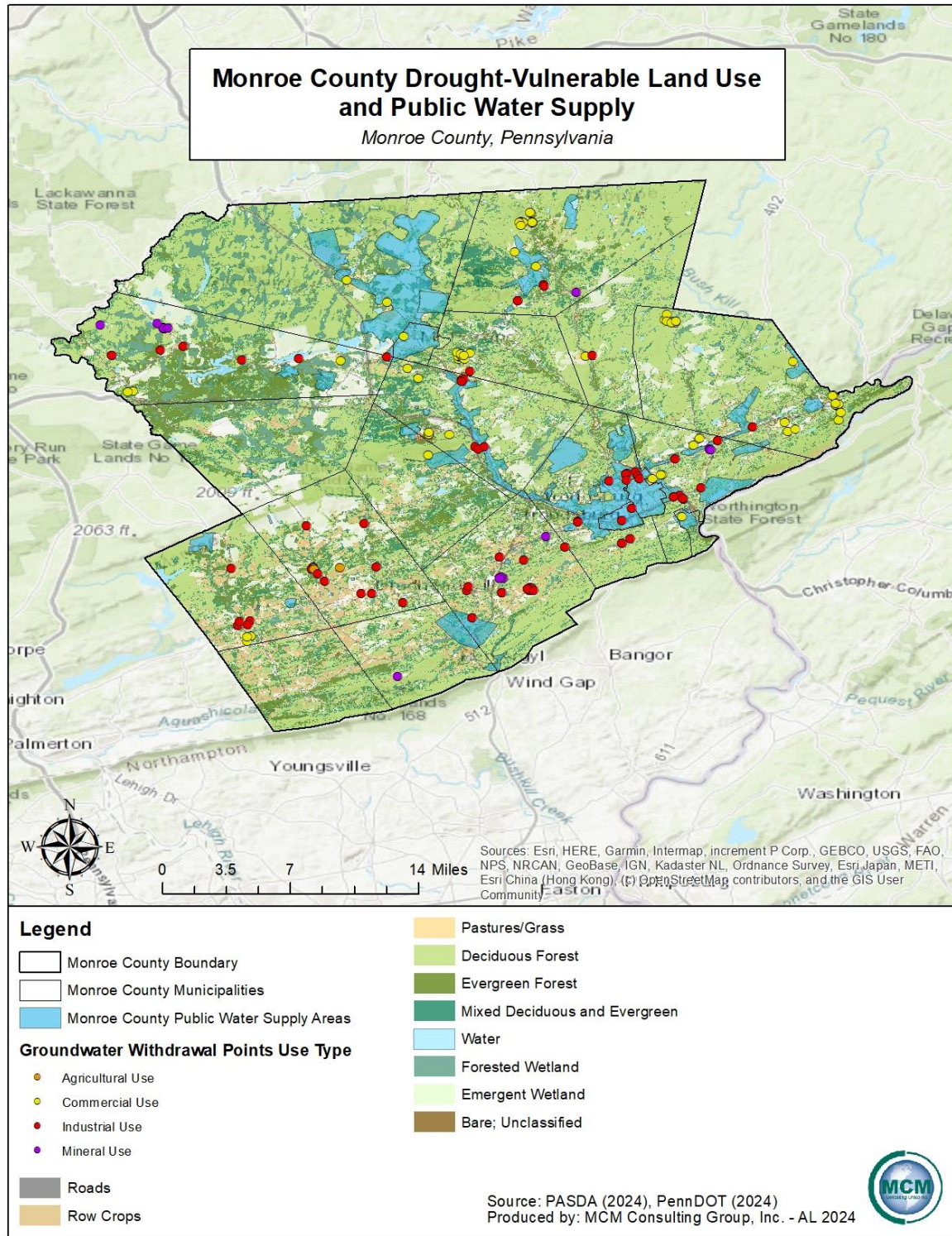
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 8 - Palmer Drought Severity Index



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 9 - Drought-Vulnerable Land Use and Public Water Supply



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.2. Extreme Temperature

4.3.2.1 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 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 27.9 °F. *Figure 13 - 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 72.8 °F. *Figure 14 - 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.

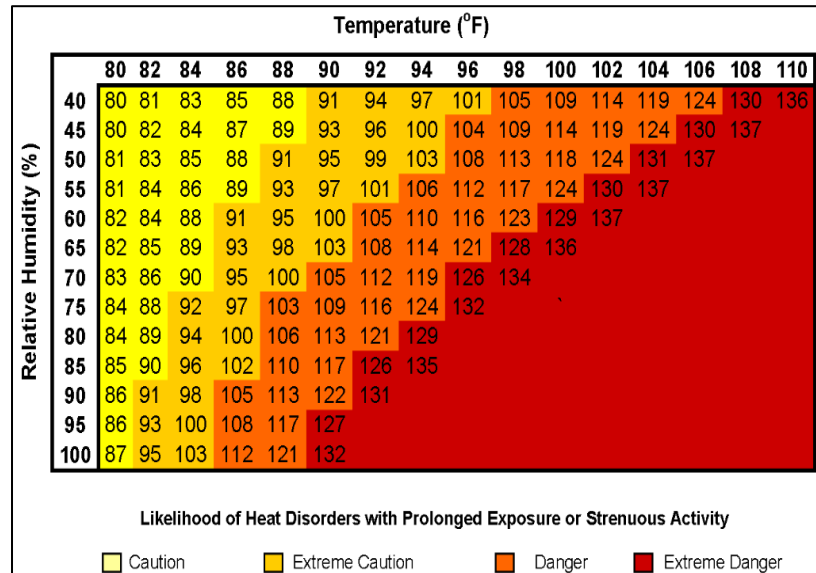
4.3.2.2 Range of Magnitude

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 10°F 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 are expected to reach 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 occur if widespread areas of the Commonwealth experienced 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, the homeless, and other vulnerable populations. The heat index is a measurement that takes into

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

account both the temperature and relative humidity, and it is calculated as shown in *Figure 10 - National Weather Service's Heat Index Matrix*.

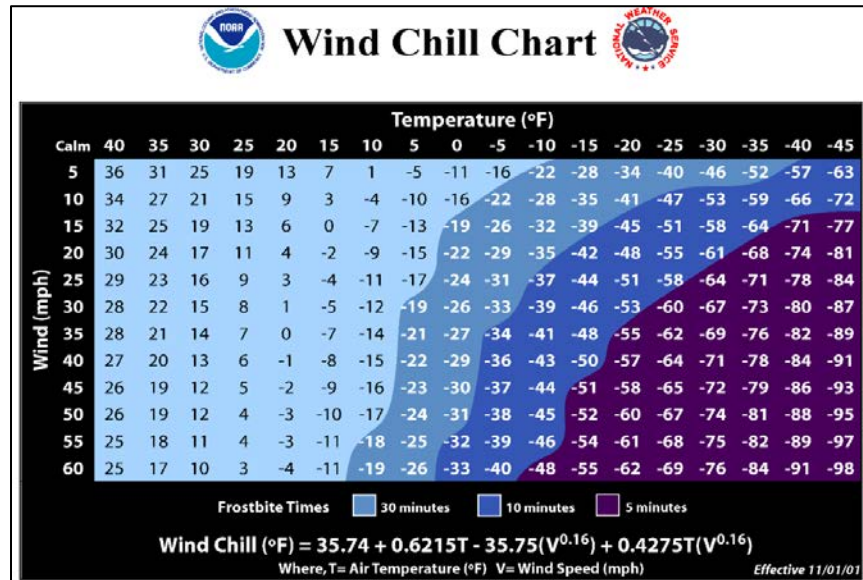
Figure 10 - National Weather Service's Heat Index Matrix



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 11 - National Weather Service's Wind Chill Matrix*.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 11 - National Weather Service's Wind Chill Matrix



Source: (NOAA NWS, 2001)

4.3.2.3 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 16 - 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 2023. Due to the source used, no further events have been documented since 2022, however, events most likely have occurred without being documented. With a total of nineteen different extreme temperature events that have occurred, fourteen 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 regarding 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 787 extreme temperature episodes in Pennsylvania from 2000 to 12/31/2023, resulting in a total of ninety-seven deaths and 103 injuries. Out of the 787 events, 525 of them were extreme cold related with four deaths. The other 262 events were extreme heat related with 93 deaths and 103 injuries across the state. The biggest event began on July 21, 2011 and ended on July 24, 2011. This event also had a significant effect on Monroe County itself. In the 2011 event, there were a total

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

of twenty-two deaths and twenty injuries during the course of the event across the entire Commonwealth of Pennsylvania. Record-breaking heat temperatures were experienced in over thirty different counties.

Table 16 - Past Extreme Temperature Occurrences for Monroe County

Past Extreme Temperature Occurrences for Monroe County		
Location	Date	Type
Monroe County	05/02/2001	Excessive Heat
Monroe County	01/26/2007	Extreme Cold/Wind Chill
Monroe County	02/05/2007	Extreme Cold/Wind Chill
Monroe County	02/06/2007	Extreme Cold/Wind Chill
Monroe County	06/07/2008	Excessive Heat
Monroe County	07/16/2008	Excessive Heat
Monroe County	07/06/2010	Excessive Heat
Monroe County	07/21/2011	Excessive Heat
Monroe County	01/04/2014	Extreme Cold/Wind Chill
Monroe County	01/07/2014	Extreme Cold/Wind Chill
Monroe County	01/22/2014	Extreme Cold/Wind Chill
Monroe County	01/07/2015	Extreme Cold/Wind Chill
Monroe County	02/13/2015	Extreme Cold/Wind Chill
Monroe County	02/15/2015	Extreme Cold/Wind Chill
Monroe County	02/15/2015	Extreme Cold/Wind Chill
Monroe County	02/19/2015	Extreme Cold/Wind Chill
Monroe County	02/24/2015	Extreme Cold/Wind Chill
Monroe County	02/13/2016	Extreme Cold/Wind Chill
Monroe County	12/23/2022	Extreme Cold/Wind Chill
Source: NOAA, 2024		

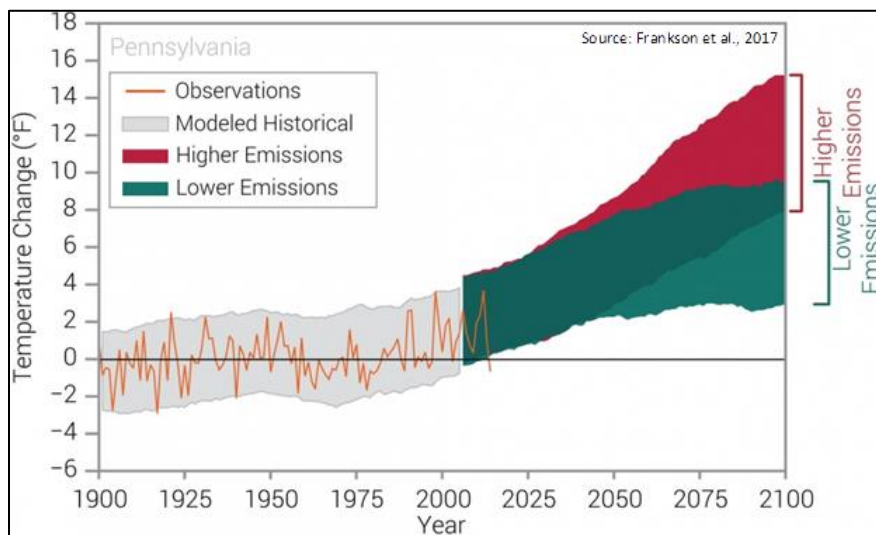
4.3.2.4 Future Occurrence

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 12 – Observed and Projected Temperature Change 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 12 - Observed and Projected Temperature Change for Pennsylvania



Source: (Frankson et al., 2017)

4.3.2.5 Vulnerability Assessment

Extreme temperatures are usually a regional hazard when they occur. The aging adult population (sixty-five years or older, accounting for 18.3% of Monroe County population) and the child population (five years or younger, accounting for 4.6% of Monroe County population) 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 which some consumers may be unable to afford. 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 would put a large population at great risk. Extreme temperature events can also drastically increase the volume of emergency calls, potentially overwhelming the public safety communications center. Extreme heat events can also contribute to drought conditions, which in turn increase the risk of wildfire, as discussed in Section 4.3.8.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

All properties in Monroe County that are part of the National Register of Historic Places have the same risk to extreme temperature. No one property has a greater risk than the others, but each of the historic and cultural properties is vulnerable at some level.

Municipalities with high risk due to extreme temperature:

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Delaware Water Gap Borough
- East Stroudsburg Borough
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Mount Pocono Borough
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stroud Township
- Stroudsburg Borough
- Tobyhanna Township
- Tunkhannock Township

Extreme temperatures can have a significant impact on land use within Monroe County. Higher temperatures can affect the mountain snowpacks and vegetation land. It is important to note that higher land use and irrigation can cause more intense extreme temperatures. Based on this information it can be speculated that higher land use within the municipalities in Monroe County will be impacted.

As seen in *Table 3 – Population Change in Monroe County*, thirteen of the twenty municipalities in Monroe County have experienced a population loss since the 2010 decennial census. Nine municipalities have seen a net population increase from the 2010 decennial census to the 2020 decennial census. Based on this information, it can be speculated that East Stroudsburg Borough, Middle Smithfield Township, Price Township, Smithfield Township, Stroud Township, Tobyhanna Township, and Tunkhannock Township may have an increased vulnerability to extreme temperatures, since 2010, due to the increase in population. Populations in Monroe County, including the socially vulnerable and unserved populations, are at different levels of vulnerability. The socially vulnerable have an increased risk due to the unsheltered or homeless not having proper, and adequate, access to shelter and heating, ventilation, and air conditioning (HVAC) to protect them from extreme temperature events.

Extreme temperatures can have a significant impact on natural areas. Consecutive days of excessive heat or extreme cold can lead to the diminishment of natural habitats such as forests, rivers, and mountains as seen in Monroe County. Excessive heat and extreme cold can cause these areas to lose the nourishment that is needed for these areas to survive and destroy the

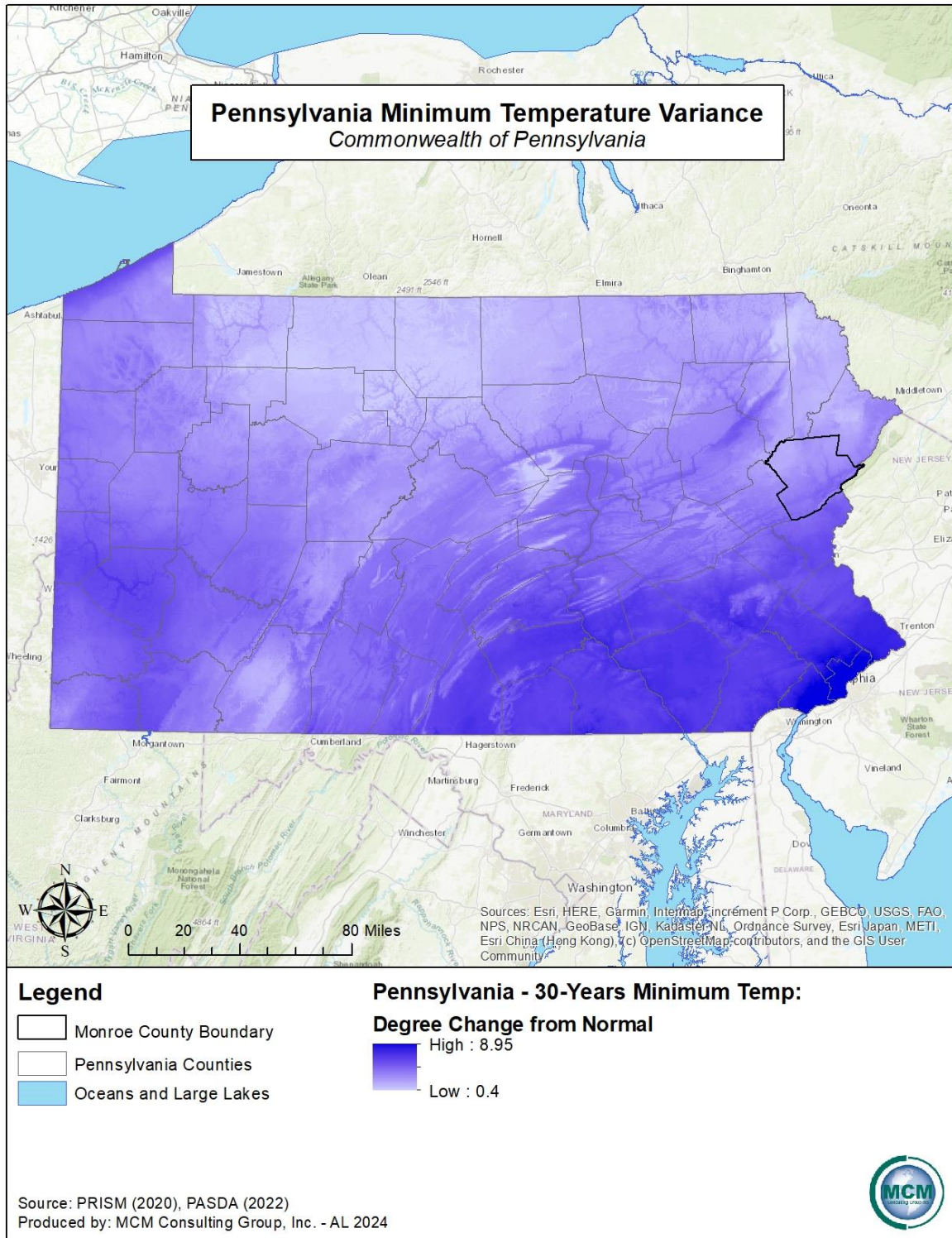
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

equilibrium within them. If trends continue there will be more days of excessive heat in the coming years that could impact the equilibrium in these natural areas and change their geographic features. Extreme temperatures and lack of rainfall can lead to drought and the diminishment of rivers and vegetation within the area.

Extreme temperatures can have significant impacts on systems and community lifelines that are essential for the operations of an area. The changing nature of extreme temperature events could account for different levels of impact for every system in an area. For example, excessive cold may disrupt water systems, potentially resulting in frozen or broken pipes due to water freezing in the system because of the lower temperatures. Extreme heat events may increase the demand for potable water for consumption and water for irrigation. This could result in lower reservoir levels and increased concern for water rationing. If extreme temperatures continue for an extended period, or if the extreme temperatures occur while a drought event is ongoing, the vulnerability of an area could be critical. Extreme temperatures could impact the power system by causing an increase for air conditioning in extreme heat events. When power demand is high for an already over-taxed power system, rolling power interruptions or brownouts can occur. This is more typical in the western United States but could occur in Pennsylvania if the conditions are met.

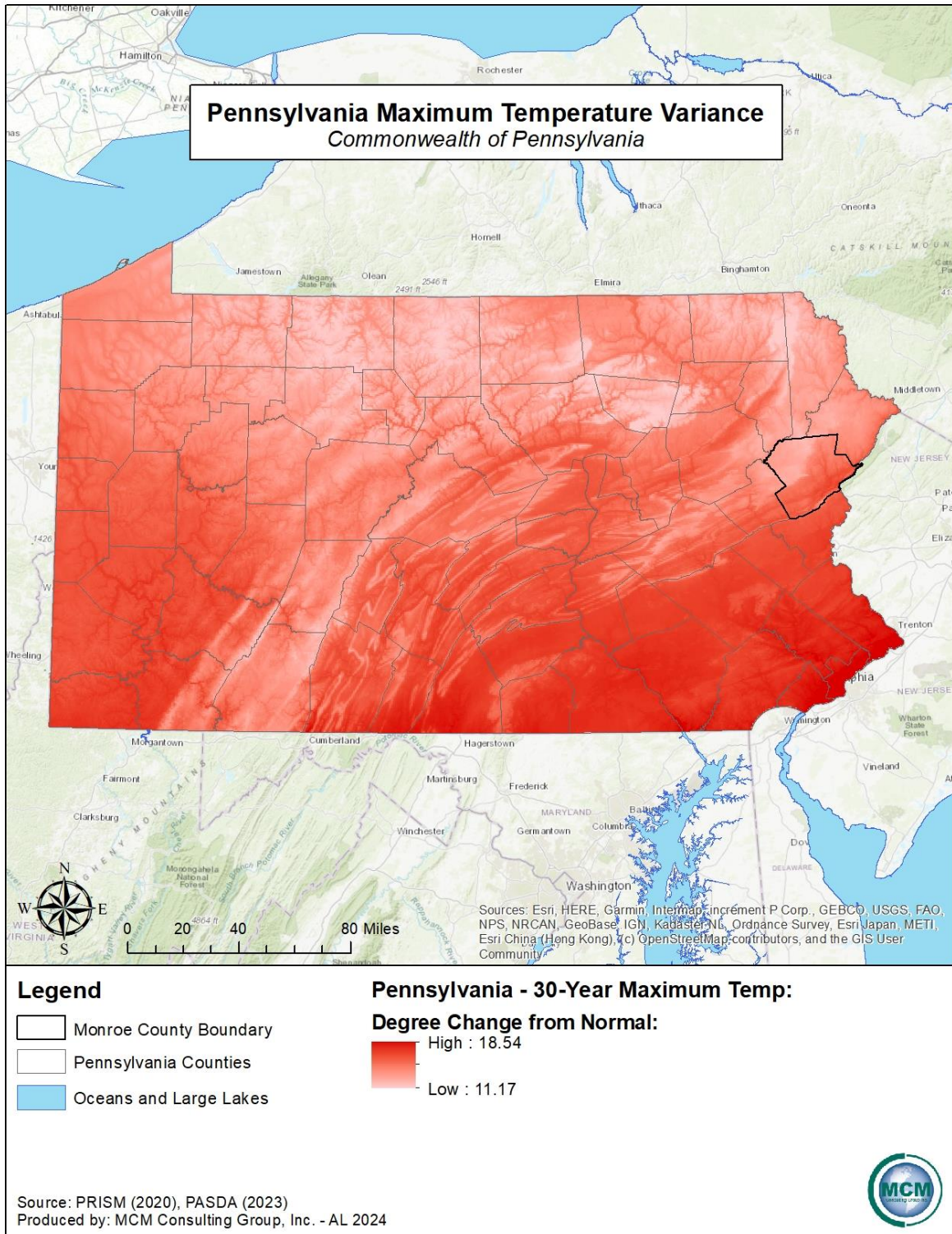
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 13 - Average Minimum Temperature Trends for Pennsylvania



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 14 - Average Maximum Temperature Trends for Pennsylvania



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.3. Flooding, Flash Flooding, and Ice Jam Flooding

4.3.3.1 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 the result of heavy, localized precipitation falling in a short period of time over a given location, often in mountain streams and mountainous regions, and in urban areas where much of the ground is covered in impervious surfaces. Flash floods are relatively common in Monroe County and the severity of those 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 flash 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 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.

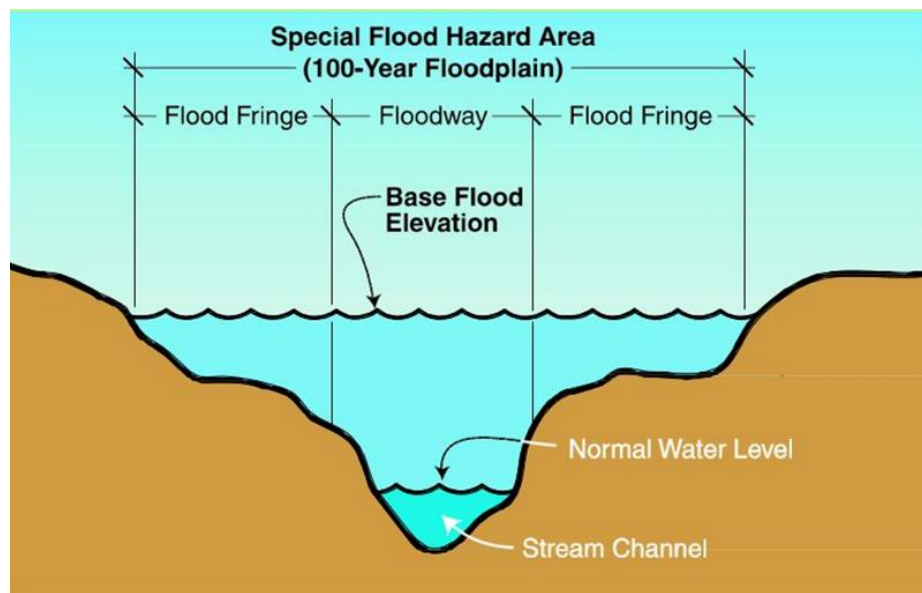
Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood event. Flood recurrence intervals are explained in more detail in section 4.3.3.4. However, in assessing the potential spatial extent of flooding, it is important to know that a floodplain associated with a flood that has a 10% chance of occurring each year is smaller than a floodplain associated with a flood that has a 0.2% chance of occurring.

The National Flood Insurance Program (NFIP) publishes digital flood insurance rate maps (DFIRMs). These maps identify the 1% annual chance flood area. The special flood hazard area (SFHA) and base flood elevations (BFE) are developed from the 1% annual chance flood event as seen in *Figure 15 – Flooding and Floodplain Diagram*. Structure located within the SFHA has 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 the Monroe County local government. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to the following high-risk special flood hazard areas in *Table 17 – 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 community lifeline facilities identified using the most current DFIRM data for Monroe County.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 community lifeline 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, or store hazardous materials. A flood could potentially release and transport hazardous materials throughout the area. Most flood damage to a property and structure located in the floodplain is caused by water exposure to the interior, high velocity water, and debris flow.

Figure 15 - Flooding and Floodplain Diagram



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 17 - Flood Hazard High Risk Zones

Flood Hazard High Risk Zones	
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.
Source: FEMA, 2017	

4.3.3.2 Range of Magnitude

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

- Delaware River
 - Brodhead Creek
 - Pocono Creek
 - McMichael Creek
- Lehigh River
 - 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. This is of particular concern for areas along steep slopes and on the edges of valleys throughout Monroe County.

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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

rainfall over a short time can cause flash flood events. Flash floods can occur very quickly and with little warning. A flash flood can also be deadly because of the rapid rise in water levels and devastating flow velocities. The more developed areas in the county can easily be susceptible to flash floods because of the significant presence of impervious surfaces, such as streets, sidewalks, parking lots, and driveways. 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 areas are largely covered in impermeable surfaces such as parking lots, paved roadways, and other developed areas. The county occasionally experiences intense rainfall from tropical storms 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 citizens. Severe flooding can also result in significant property damage, potentially disrupting the regular function of community lifeline facilities and can have widespread negative effects on local economies. Industrial, commercial, and public infrastructure facilities can become inundated with flood waters, threatening the continuity of government and business. The vulnerable populations must be identified and located in flooding situations, as they are often homebound. Mobile homes and manufactured structures are especially vulnerable to high water levels. Flooding can have significant environmental impacts when the flood water releases and/or transport hazardous materials.

Severe flooding also comes with secondary effects that could have long lasting impacts on the population, economy, and infrastructure within 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. Community lifelines, such as sewage and water treatment facilities, could fail, causing sewage overflows and the contamination of groundwater and drinking water. Flooding also has the potential to trigger cascading 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 section 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. The FEMA Global Flood Risk Report and other 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 18 – HAZUS Building Loss*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figures. The total business interruption values occurring from a proposed 100-year flood based on FEMA HAZUS data is illustrated in *Table 19 – HAZUS Business Interruption Economic Loss Figures*. *Figure 16 – Loss by Occupancy Type* illustrates the breakdown of economic losses by either residential, commercial, industrial, or other use type.

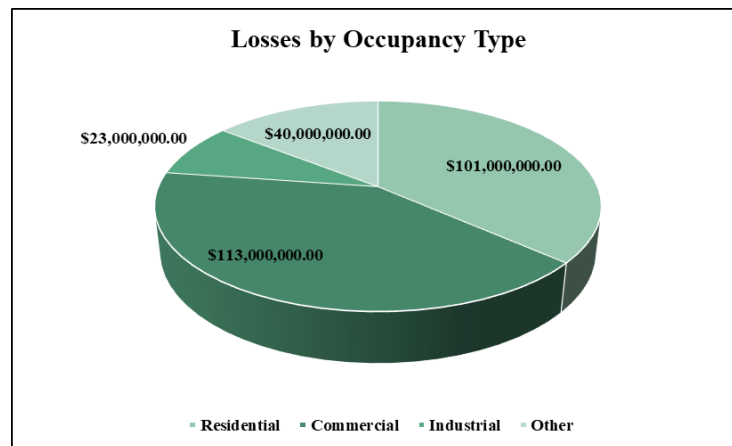
Table 18 - HAZUS Building Loss Figures

HAZUS Building Economic Loss Figures					
	Residential	Commercial	Industrial	Other	Total
Building:	\$47,270,000.00	\$10,930,000.00	\$5,650,000.00	\$1,110,000.00	\$64,960,000.00
Content:	\$27,270,000.00	\$32,940,000.00	\$13,950,000.00	\$6,490,000.00	\$80,650,000.00
Inventory:	\$0.00	\$470,000.00	\$2,240,000.00	\$20,000.00	\$2,730,000.00
Subtotal:	\$74,540,000.00	\$44,340,000.00	\$21,840,000.00	\$7,620,000.00	\$148,340,000.00
Source: HAZUS, 2024					

Table 19 - HAZUS Business Interruption Economic Loss Figures

HAZUS Business Interruption Economic Loss Figures					
	Residential	Commercial	Industrial	Other	Total
Income:	\$1,580,000.00	\$25,390,000.00	\$300,000.00	\$2,570,000.00	\$29,840,000.00
Relocation:	\$13,670,000.00	\$6,640,000.00	\$370,000.00	\$1,010,000.00	\$21,690,000.00
Rental Income:	\$7,560,000.00	\$4,900,000.00	\$80,000.00	\$120,000.00	\$12,660,000.00
Wage:	\$3,730,000.00	\$31,590,000.00	\$540,000.00	\$28,730,000.00	\$64,590,000.00
Subtotal:	\$26,540,000.00	\$68,520,000.00	\$1,290,000.00	\$32,430,000.00	\$128,780,000.00
Source: HAZUS, 2024					

Figure 16 - Loss by Occupancy Type



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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 sediments, which improves soil fertility. However, human development often disrupts natural riparian buffers by changing land use and land cover, and the introduction of chemical or biological contaminants that often accompany human presence and can contaminate habitats after flood events.

4.3.3.3 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, inclement weather, tropical storms, and other issues. A summary of recent flood event history for Monroe County from January 2000 to March 2024 is found in *Table 20 – Past Flood and Flash Flood Events*. Details of each event can be found in NOAA’s National Center for Environmental Information (NCEI) database. Additional data was also acquired by examining Monroe County’s WebEOC information from 2020 to 2024.

Table 20 - Past Flood and Flash Flood Events

Past Flood and Flash Flood Events			
Event Location	Event Date	Event Type	Property Damage Estimate
Monroe County (Entire County)	12/17/2000	Flash Flood	\$0.00*
Monroe County (Southeast Area)	07/25/2001	Flash Flood	\$0.00*
Monroe County (North Area)	05/28/2002	Flash Flood	\$0.00*
Monroe County (North Area)	06/26/2002	Flash Flood	\$0.00*
Monroe County (Northwest Area)	07/23/2002	Flash Flood	\$0.00*
Monroe County (South Area)	06/12/2003	Flash Flood	\$0.00*
Monroe County (Entire County)	06/21/2003	Flood	\$0.00*
Chestnuthill Township	08/16/2003	Flash Flood	\$0.00*
Monroe County (Entire County)	09/23/2003	Flood	\$0.00*
Monroe County (Entire County)	12/11/2003	Flood	\$0.00*
Monroe County (Central Area)	08/12/2004	Flash Flood	\$0.00*
Monroe County (Entire County)	09/18/2004	Flood	\$8,000,000.00*
Monroe County (Entire County)	09/18/2004	Flash Flood	\$8,000,000.00*
Monroe County (Entire County)	01/14/2005	Flood	\$0.00*
Monroe County (Entire County)	04/02/2005	Flood	\$40,000,000.00*
Monroe County (Entire County)	10/08/2005	Flood	\$0.00*

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Past Flood and Flash Flood Events			
Event Location	Event Date	Event Type	Property Damage Estimate
Monroe County (Entire County)	01/18/2005	Flood	\$0.00*
Monroe County (Entire County)	06/27/2006	Flood	\$16,000,000.00*
Monroe County (Entire County)	06/27/2006	Flash Flood	\$0.00*
Smithfield Township	04/15/2007	Flood	\$0.00*
East Stroudsburg Borough	06/01/2007	Flash Flood	\$0.00*
Price Township	06/14/2008	Flash Flood	\$0.00*
Hamilton Township	06/14/2008	Flash Flood	\$0.00*
Hamilton Township	08/15/2008	Flash Flood	\$0.00*
Pocono Township	07/29/2009	Flash Flood	\$0.00*
Hamilton Township	07/29/2009	Flash Flood	\$0.00*
Smithfield Township	09/30/2010	Flood	\$0.00*
Tobyhanna Township	10/01/2010	Flood	\$0.00*
Smithfield Township	03/07/2011	Flood	\$0.00*
Smithfield Township	03/10/2011	Flood	\$0.00*
Stroud Township	05/19/2011	Flash Flood	\$0.00*
Mt Pocono Borough	08/28/2011	Flash Flood	\$0.00*
Smithfield Township	08/28/2011	Flood	\$175,000.00*
East Stroudsburg Borough	09/07/2011	Flood	\$0.00*
Stroudsburg Borough	09/08/2011	Flood	\$0.00*
Chestnuthill Township	09/28/2011	Flash Flood	\$0.00*
East Stroudsburg Borough	05/26/2012	Flash Flood	\$0.00*
Pocono Township	05/26/2012	Flash Flood	\$25,000.00*
Pocono Township	05/26/2012	Flash Flood	\$0.00*
Chestnuthill Township	09/04/2012	Flash Flood	\$0.00*
Stroudsburg Borough	09/04/2012	Flash Flood	\$0.00*
Tobyhanna Township	09/18/2012	Flash Flood	\$0.00*
Middle Smithfield Township	07/01/2013	Flash Flood	\$0.00*
Tobyhanna Township	07/02/2013	Flood	\$0.00*
East Stroudsburg Borough	07/28/2013	Flash Flood	\$0.00*
Stroudsburg Borough	08/09/2013	Flash Flood	\$0.00
Stroudsburg Borough	01/11/2014	Flood	\$0.00*
Tobyhanna Township	06/14/2014	Flood	\$0.00*
Tobyhanna Township	06/30/2015	Flash Flood	\$100,000.00*

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Past Flood and Flash Flood Events			
Event Location	Event Date	Event Type	Property Damage Estimate
Mt Pocono Borough	06/30/2015	Flash Flood	\$0.00*
Tobyhanna Township	07/01/2015	Flash Flood	\$0.00*
Stroudsburg Borough	07/06/2019	Flash Flood	\$0.00*
East Stroudsburg Borough	07/31/2019	Flash Flood	\$0.00*
Jackson Township	08/06/2019	Flash Flood	\$0.00*
Stroudsburg Borough	10/31/2019	Flash Flood	\$0.00*
Tunkhannock Township	10/31/2019	Flash Flood	\$0.00*
Hamilton Township	08/04/2020	Flash Flood	\$0.00*
East Stroudsburg Borough (Airport)	08/18/2021	Flash Flood	\$0.00*
Mt Pocono Borough (Airport)	08/22/2021	Flash Flood	\$0.00*
Stroud Township	08/22/2021	Flash Flood	\$0.00*
Pocono Township	08/22/2021	Flash Flood	\$0.00*
Delaware Water Gap Borough	08/22/2021	Flash Flood	\$0.00*
Pocono Township	08/22/2021	Flash Flood	\$0.00*
Chestnuthill Township	08/22/2021	Flash Flood	\$0.00*
Eldred Township	08/22/2021	Flash Flood	\$0.00*
East Stroudsburg Borough	08/22/2021	Flash Flood	\$0.00*
Polk Township	08/22/2021	Flash Flood	\$0.00*
Tunkhannock Township	08/23/2021	Flash Flood	\$0.00*
Middle Smithfield Township	08/23/2021	Flash Flood	\$0.00*
Pocono Township	09/01/2021	Flash Flood	\$0.00*
Stroudsburg Borough	09/01/2021	Flash Flood	\$0.00*
Pocono Township	09/01/2021	Flood	\$0.00**
Stroudsburg Borough	09/01/2021	Flood	\$0.00**
Monroe County (Entire County)	10/27/2021	Flood	\$0.00**
Tobyhanna Township	07/14/2023	Flash Flood	\$0.00*
Hamilton Township	12/18/2023	Flood	\$0.00**
Monroe County (Entire County)	12/18/2023	Flood	\$0.00**
Monroe County (Entire County)	01/08/2024	Flood	\$0.00**
Total:			\$72,300,000.00**
Source: NCEI NOAA, 2024			
*Property Damage Values are estimated and are not exact figures. Data from NCEI			
** Property Damage Values are not calculated for information from WebEOC			

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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; at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage. *Table 21 – Repetitive Loss Properties* illustrates the communities that have repetitive loss properties, the total building payments, the contents payments, and the number of losses and properties. There are thirty-eight repetitive loss properties in Monroe County. *Table 22 – Summary of Type of Repetitive Loss Properties by Municipality* illustrates the breakdown of type of repetitive loss properties in Monroe County.

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. *Table 23 – 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 provided by PEMA.

Most municipalities in Monroe County participate in the NFIP. Information on each participating municipality can be found in *Table 24 – Municipal NFIP Policies & Vulnerability*.

Table 21 - Repetitive Loss Properties

Repetitive Loss Properties						
Community Name	Community Number	Cumulative Building Payment	Cumulative Contents Payment	Sum of Total Paid	Losses	Properties
Barrett Township	421884	\$4,213.79	\$743.90	\$4,957.69	2	1
Chestnuthill Township	421885	\$18,583.93	\$0.00	\$18,583.93	3	1
Coolbaugh Township	421886	\$20,805.91	\$0.00	\$20,805.91	2	1
Delaware Water Gap Borough	420690	\$68,184.31	\$0.00	\$68,184.31	3	1
Delaware Water Gap Borough	420690	\$1,053,241.27	\$1,131,749.59	\$2,184,990.86	3	1

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Repetitive Loss Properties						
Community Name	Community Number	Cumulative Building Payment	Cumulative Contents Payment	Sum of Total Paid	Losses	Properties
Eldred Township	421887	\$17,462.60	\$11,903.04	\$29,365.64	3	1
Hamilton Township	421888	\$15,632.94	\$0.00	\$15,632.94	2	1
Hamilton Township	421888	\$29,678.66	\$0.00	\$29,678.66	2	1
Middle Smithfield Township	421890	\$15,406.33	\$0.00	\$15,406.33	2	1
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	\$431,044.06	\$84,005.24	\$515,049.30	4	1
Smithfield Township	421896	\$353,378.78	\$56,855.28	\$410,234.06	4	1
Smithfield Township	421896	\$98,054.42	\$16,421.69	\$114,476.11	3	1
Smithfield Township	421896	\$105,542.81	\$100.00	\$105,642.81	3	1
Smithfield Township	421896	\$177,331.33	\$61,745.87	\$239,077.20	3	1
Smithfield Township	421896	\$162,861.92	\$0.00	\$162,861.92	3	1
Smithfield Township	421896	\$157,678.35	\$100,601.57	\$258,279.92	4	1
Smithfield Township	421896	\$60,238.61	\$24,716.27	\$84,954.88	3	1
Smithfield Township	421896	\$124,283.22	\$18,558.01	\$142,841.23	5	1
Smithfield Township	421896	\$27,383.10	\$6,077.22	\$33,460.32	2	1
Smithfield Township	421896	\$32,128.56	\$271.00	\$32,399.56	3	1
Smithfield Township	421896	\$10,043.21	\$10,600.00	\$20,643.21	2	1
Smithfield Township	421896	\$55,297.47	\$29,168.72	\$84,466.19	3	1

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Repetitive Loss Properties						
Community Name	Community Number	Cumulative Building Payment	Cumulative Contents Payment	Sum of Total Paid	Losses	Properties
Smithfield Township	421896	\$159,063.31	\$30,956.44	\$190,019.75	3	1
Smithfield Township	421896	\$0.00	\$28,580.26	\$28,580.26	2	1
Smithfield Township	421896	\$24,090.55	\$0.00	\$24,090.55	2	1
Smithfield Township	421896	\$28,114.12	\$0.00	\$28,114.12	2	1
Stroud Township	420693	\$6,085.46	\$11,849.65	\$17,935.11	2	1
Stroud Township	420693	\$65,122.50	\$37,319.32	\$102,441.82	3	1
Stroud Township	420693	\$2,039.49	\$9,492.86	\$11,532.35	2	1
Stroud Township	420693	\$8,967.01	\$36,414.15	\$45,381.16	3	1
Stroud Township	420693	\$6,875.89	\$0.00	\$6,875.89	2	1
Stroud Township	420693	\$6,011.93	\$0.00	\$6,011.93	2	1
Stroud Township	420693	\$10,577.74	\$0.00	\$10,577.74	2	1
Stroudsburg Borough	430694	\$8,328.87	\$0.00	\$8,328.87	3	1
Stroudsburg Borough	430694	\$36,690.87	\$0.00	\$36,690.87	2	1
Tobyhanna Township	421897	\$25,005.07	\$1,173.93	\$26,179.00	2	1
Total:		\$3,479,852.28	\$1,709,304.01	\$5,189,156.29	101	38
Source: FEMA, 2024						

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 22 - 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
Coolbaugh Township	0	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	2	0	0
Ross Township	0	0	1	0	0
Smithfield Township	5	0	17	0	0
Stroud Township	4	0	3	0	0
Stroudsburg Borough	0	0	2	0	0
Tobyhanna Township	0	0	1	0	0
Source: FEMA, 2024					

Table 23 - Severe Repetitive Loss Properties

Severe Repetitive Loss Properties						
Community Name	Community Number	Cumulative Building Payments	Cumulative Contents Payments	Sum of Total Paid	Losses	Properties
Chestnuthill Township	421885	\$57,431.42	\$0.00	\$57,431.42	4	1
Hamilton Township	421888	\$244,356.07	\$14,160.84	\$258,516.91	6	1
Smithfield Township	421896	\$69,161.67	\$14,748.49	\$83,910.16	4	1
Smithfield Township	421896	\$109,400.51	\$43,924.04	\$153,324.55	4	1
Smithfield Township	421896	\$301,525.28	\$28,548.99	\$330,074.27	3	1
Smithfield Township	421896	\$2,359,584.38	\$625,225.09	\$2,984,809.47	4	1
Smithfield Township	421896	\$225,146.12	\$37,033.95	\$262,180.07	3	1
Total:		\$3,366,605.45	\$763,641.40	\$4,130,246.85	28	7
Source: FEMA, 2024						

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 24 - Municipal NFIP Policies & Vulnerability

Municipal Participation in the National Flood Insurance Program			
Municipal Name	Community Number	Initial FHBM	Latest Mapping Dates
Barrett Township	421884	11/15/1974	05/02/2013
Chestnuthill Township	421885	11/15/1974	05/02/2013
Coolbaugh Township	421886	11/26/1976	05/02/2013
Delaware Water Gap Borough	420690	08/05/1977	05/02/2013
East Stroudsburg Borough	420691	05/24/1974	05/02/2013
Eldred Township	421887	12/06/1974	05/02/2013
Hamilton Township	421888	11/22/1974	05/02/2013
Jackson Township	421889	01/03/1975	05/02/2013
Middle Smithfield Township	421890	12/06/1974	05/02/2013
Mount Pocono Borough	420692	01/24/1975	05/02/2013
Paradise Township	421891	04/11/1975	05/02/2013
Pocono Township	421892	12/06/1974	05/02/2013
Polk Township	421893	11/22/1974	05/02/2013
Price Township	421894	11/15/1974	05/02/2013
Ross Township	421895	11/29/1974	05/02/2013
Smithfield Township	421896	01/24/1975	05/02/2013
Stroud Township	420693	01/17/1975	05/02/2013
Stroudsburg Borough	420694	06/21/1974	05/02/2013
Tobyhanna Township	421897	01/03/1975	05/02/2013
Tunkhannock Township	421898	01/31/1975	05/02/2013
Source: FEMA, 2024			
Note: FHBM: Flood Hazard Boundary Map			

4.3.3.4 Future Occurrence

Flooding is a frequent problem throughout the Commonwealth of Pennsylvania. Monroe County will certainly be impacted by 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

the 1% annual chance flood, also known as the base flood of a 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 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 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 shown in *Table 25 – Flood Probability Summary*.

Table 25 - Flood Probability Summary

Flood Probability Summary	
Flood Recurrence Intervals	Annual Chance of Occurrence
10-year	10.00%
50-year	2.00%
100-year	1.00%
500-year	0.20%
Source: FEMA, 2009	

The future occurrences of flooding, flash flooding, and ice jam flooding in Monroe County are expected to increase due to the rate of climate change in the Commonwealth of Pennsylvania, and the world. Climate change will include ocean temperature rise, which result in more intense hurricanes and tropical storm seasons in the Atlantic Ocean. This intensity could result in an increase in the number of hurricanes and tropical storms that could impact Pennsylvania and Monroe County. These hurricanes and tropical storms could result in a large volume of precipitation occurring over a short period of time, resulting in a flood or flash flood event. It is important to note that these impacts are the secondary result of other hazards, increased by climate change, that could result in flooding events.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.3.5 Vulnerability Assessment

Riverine and Stream Flooding

Monroe County is vulnerable to stream and river flooding on an annual basis. Flooding puts the entire population at some level of risk, whether through flooding of homes, businesses, places of employment, roadways, sewers, or water infrastructure. Flooding can cause significant power outages and poor road conditions that can lead to heightened transportation accident risk.

County community lifelines are the most vulnerable buildings and services when riverine and stream flooding is considered. Community lifeline 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 community lifeline facilities that are located within the special flood hazard area.

Table 26 – Expected Damage to Essential Facilities (HAZUS) illustrates the estimated damage levels to certain essential facilities based on classifications in the HAZUS General Building Stock. There are three facilities estimated to be at least moderately damaged by a 100-year flooding event in the HAZUS scenario completed for Monroe County. Of those three facilities, all will undergo a loss of use. It is estimated that one emergency operations center, one fire station, and one school will be moderately damaged by this scenario. Also, the school will experience enough damage to result in loss of use and the education of the students would need to be moved to another location until such a time that repairs can be completed. Plans for such an event, and the damage that would result to essential facilities, must be in place to successfully mitigate the potential disruption to community lifeline facilities.

Table 26 - Expected Damage to Essential Facilities (HAZUS)

Expected Damage to Essential Facilities				
Classification	Number of Facilities			
	Total:	At Least Moderate:	At Least Substantial:	Loss of Use:
Emergency Operations Center	1	1	0	1
Fire Stations	25	1	0	1
Hospitals	3	0	0	0
Police Stations	9	0	0	0
Schools	45	1	0	1

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 27 - County Structures Within Special Flood Hazard Area shows the number of site structure address points within the Special Flood Hazard Area, as well as the community lifeline facilities. This information was compiled using the Special Flood Hazard Area and GIS data provided by the Monroe County Planning Commission.

Table 27 - County Structures Within Special Flood Hazard Area

County Structures Within Special Flood Hazard Area		
Municipality	Site Structure Address Points Within Flood Area	Community Lifelines within Flood Area
Barrett Township	63	0
Chestnuthill Township	138	0
Coolbaugh Township	264	1
Delaware Water Gap Borough	48	0
East Stroudsburg Borough	138	3
Eldred Township	43	0
Hamilton Township	176	1
Jackson Township	3	0
Middle Smithfield Township	106	0
Mount Pocono Borough	2	0
Paradise Township	37	0
Pocono Township	157	0
Polk Township	112	1
Price Township	31	0
Ross Township	30	0
Smithfield Township	334	2
Stroud Township	319	1
Stroudsburg Borough	580	2
Tobyhanna Township	107	0
Tunkhannock Township	1	0
Totals:	2,689	11

Table 28 – Community Lifeline Facilities Additional Information illustrates the additional information including name, the municipality, and the type of facility for each community lifeline facility that falls within the Special Flood Hazard Area for Monroe County. This information was compiled using Monroe County’s GIS information with the assistance of the Monroe County Planning Commission.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 28 - Community Lifeline Facilities Additional Information

Community Lifeline Facilities Additional Information		
Community Lifeline Type:	Facility Name:	Municipality:
Energy	Electric Substation 66	Coolbaugh Township
Food, Hydration, Shelter	Walmart Supercenter	East Stroudsburg Borough
Food, Hydration, Shelter	Weis Markets	
Water Systems	East Stroudsburg Sewer Authority	
Safety and Security	PennDOT – Driver License Center	Hamilton Township
Energy	Electric Substation 69	Polk Township
Safety and Security	Shawnee Fire Company #1 - Worthington	Smithfield Township
Water Systems	Delaware Water Gap Wastewater	
Safety and Security	Stroud Township VFD - Analomink	Stroud Township
Energy	Electric Substation 78	Stroudsburg Borough
Safety and Security	Housing Authority of Monroe	

In addition to the items listed above, there are five properties that are considered historic and cultural for Monroe County that are registered with the National Register of Historic Place that are in the Special Flood Hazard Area. These properties are the Delaware, Lackawanna, and Western Railroad Freight Station, the East Stroudsburg Armory, the Fenner-Snyder Mill, the Captain John Shoemaker House, and the Stroud Mansion. These locations are at an increased risk of flooding due to annual flood events unless mitigated.

The steering committee for the Monroe County hazard mitigation plan update outlined that Pocono Creek presented significant vulnerabilities to the buildings, communities, and populations of Monroe County. Pocono Creek is a tributary of McMichael Creek and Brodhead Creek and meets McMichael Creek near Stroudsburg Borough. This creates a unique scenario where this waterbody is close to commercial, residential, and population centers. The location outlines that a densely populated area directly interfaces with a creek that has previously resulted in flooding impacts.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 is reflected in *Table 20 – Past Flood and Flash Flood Events* above.

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

- Chestnuthill Township
- East Stroudsburg Borough
- Hamilton Township
- Mount Pocono Borough
- Pocono Township
- Stroudsburg Borough
- 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 populations and community lifelines.

Municipalities with an increased risk to flooding, flash flooding, and ice jam flooding (due to the intersection with the Special Flood Hazard Area):

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Delaware Water Gap Borough
- East Stroudsburg Borough
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Mount Pocono Borough
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stroud Township
- Tobyhanna Township
- Tunkhannock Township

All the population of Monroe County, including the unserved and the underserved populations, are at an increased vulnerability to flooding hazards. All municipalities in Monroe County directly interface with the regulatory flood boundaries in the county. Unserved and underserved

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

populations have the potential to be more vulnerable to flooding hazards in Monroe County. Homeless, unsheltered, and displaced people would not have housing or homes to use as a shelter in the event of a flooding hazard. Those populations also may not have easy access to warning systems or alerts for flash flooding hazards. All of the county could be at increased vulnerability, specifically any populations located on the Lehigh and Delaware rivers.

Systems in Monroe County are at increased vulnerability to flooding hazards. All the utilities in Monroe County could be adversely impacted by very specific flooding and flash flooding events. Utilities may be damaged or destroyed from a flooding event, or from a cascading hazard from flooding events. Major flooding could cause an issue in the delivery of services, including electricity, to the citizens and residents of Monroe County.

While flooding does not typically adversely affect natural areas, a comprehensive vulnerability assessment was completed for natural areas in Monroe County, including public recreation areas, state parks, state game lands, and any other outdoor or natural area resources.

The following natural areas directly intersected with areas of the Special Flood Hazard Area (SFHA) for Monroe County:

- Delaware State Forest
- Delaware Water Gap National Recreation Area
- Gouldsboro State Park
- Pinchot State Forest
- State Game Land 38
- State Game Land 127
- State Game Land 129
- State Game Land 168
- State Game Land 186
- State Game Land 221
- State Game Land 312
- State Game Land 318
- Tobyhanna State Park

Not all these locations will be impacted by every flooding event in Monroe County, but at least some of the areas listed above will be impacted due to their close proximity to the Special Flood Hazard Area (SFHA).

Impacts of flooding, flash flooding, and ice jam flooding can also be influenced by population change. As seen in *Table 3 – Population Change in Monroe County*, nine municipalities have experienced population growth between the 2010 decennial census and the 2020 decennial census. Based on this information, it can be speculated that these nine municipalities have an increased vulnerability to flooding, flash flooding, and ice jam flooding hazards, since 2010. This increased vulnerability is due to more potential development and that development encroaching on high vulnerability areas for Monroe County, including near the Special Flood Hazard Area.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Land use is a factor that has the potential to impact the vulnerability to flooding, flash flooding, and ice jam flooding in Monroe County. Land use, in the form of a built environment, such as residential and commercial expansion, especially in the Special Flood Hazard Area or areas directly adjacent, could increase the severity impact of these hazards. The change of land use from areas of easy infiltration of groundwater to impervious surfaces can increase the severity and the frequency of flash floods, increasingly in areas where flash floods have occurred in the past. Impervious surfaces in these built environments can include concrete, pavement, and macadamia and all can lead to less ground water infiltration. An influx of people, commercial enterprises, and infrastructure development also increases the vulnerability of areas to flooding, flash flooding, and ice jam flooding.

As part of this hazard mitigation planning process, the Monroe County Office of Emergency Management and the Monroe County Planning Commission solicited information and hazard areas from the public at county events. The public provided information on hazard locations and areas where those hazards have been observed. This information is included in the additional appendix of community maps for Monroe County. Some of the more specific hazard items noted on these maps for flooding include but are not limited to the following:

- Barrett Township: The public in Barrett Township identified that flooding is a particular concern along specific areas of Route 447 and that there is intermittent flooding along Route 309 at Cranberry Creek.
- Chestnuthill Township: The public outlined that in Chestnuthill Township, there are flooding concerns for McKinley Drive, Brian Lane, Towering Court near McMichaels Creek and along Kresge Farm Road and Gilbert Road.
- Coolbaugh Township: The residents and public for Coolbaugh Township illustrated that there are flooding concerns near Hemlock Drive near the Route 611 interchange.
- East Stroudsburg Borough: Flooding was outlined as a concern near the intersection of Hazen Street and Kiwanis Street.
- Hamilton Township: The public outlined that in Hamilton Township, there are flooding concerns for Turkey Hill Road, Morissey Drive, Bossardville Road, and Hamilton Road near T-236.
- Middle Smithfield Township: In Middle Smithfield Township, flooding is an issue outlined by the general public on Barren Road, Sellersville Drive at the Dewitt Lane intersection, Tom X Road, and Wapita Drive at Comanche Road.
- Pocono Township: Fantasy Drive and the intersection of Cherry Lane and Warner Road are outlined on the map set as having a potential for flooding.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- Polk Township: The public noted that Silver Spring Boulevard at Pohopoco Creek, Interchange Road at H.T.Y. Road, and Weir Mountain Road are prone to frequent and routine flooding.
- Ross Township: An identified flooding issue in Ross Township was impacts along James Way.
- Smithfield Township: The public outlined that there is a flooding issue at the intersection of Independence Road and Parkinsons Road.
- Stroudsburg Borough: There are identified flooding issues from public outreach in Stroudsburg Borough. These locations are Phillips Street and the area of Waverly Drive near Pocono Creek.
- Tobyhanna Township: The public outlined a flooding concern near Sunfish Road near the Upper Tunkhannock Creek.

The public also outlined that there are certain flash flooding issues throughout Monroe County. This information is found below:

- Barrett Township: The public in Barrett Township outlined that there is a flash flooding concern along Route 309 at Cranberry Creek.
- Chestnuthill Township: The public reviewed that there are flash flooding issues at the intersection of Evergreen Hollow Road and Merwinsburg Road, the intersection of Glenwood Road and Gilbert Road, and along Route 115.
- Pocono Township: There is at least one identified flash flooding issue in Pocono Township based on public input and this location is found at the intersection of Serfas Drive and Beehler Road.
- Polk Township: Flash flooding issues include along Interchange Road, the intersection of Hobby Acres Road and Shady Lane, and near Dotters Corner Road and Dotters Creek.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.4. Hurricane/Tropical Storm

4.3.4.1 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 and 74 miles per hour. 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 is the nor'easter, which is a large cyclone that rotates clockwise and is 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 seventy-five 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 inland of the East Coast region, designated by FEMA, as being Hurricane-Susceptible (see *Figure 17 – Pennsylvania Wind Zones*). Monroe County falls within wind zone II as shown in *Figure 17 – Pennsylvania Wind Zones*. Zone II suggests that shelters and critical facilities should be able to withstand winds that range 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 seasons are typically from June to November. 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.

4.3.4.2 Range of Magnitude

The impact tropical storms 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. Expected damage from hurricane force winds is measured using the Saffir-Simpson Scale (*Table 29 - 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. Category one storms result in very dangerous winds with some damage, while category two storms result in extremely dangerous winds with extensive damage. Category three storms result in devastating damage and category

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

four/five storms result in catastrophic damage. Although 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. Mobile homes, because they may not be well-anchored, have a greater potential to be impacted by high winds. Additionally, these storms can produce high volumes of rainfall that cause flash flooding which can be followed by stream and riverine flooding. The risk assessment and associated impact for flooding events is included in Section 4.

Table 29 - Saffir-Simpson 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

4.3.4.3 Past Occurrence

Table 30 - *History of Coastal Storms Impacting Monroe County* lists all coastal storms that have impacted Monroe County from 1952 to 2024. Figure 18 – *Historic Tropical Storms/Hurricanes in Pennsylvania* identifies some past hurricanes that had an inland path through Pennsylvania. In 1955, Hurricane Connie and Hurricane Diane caused significant damage and impact in the Delaware River Valley area, specifically around Monroe County. The quick occurrence of both Hurricane Connie and Hurricane Diane effecting the same geographic area added to the local impacts, including the inundation of low lying areas, and home and property flooding. 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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. Pennsylvania incurred \$2.8 billion in damages. There were fifty storm related deaths statewide. However, in Monroe County, the most significant effects of Hurricane Agnes were due to flooding and utility outages. Agnes was only a category one 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 Bertha impacted and caused the most damage to Monroe County. Although they were separate events, Hurricane Irene and Tropical Storm Bertha together caused significant rainfall in Monroe County. Tropical Storm Bertha caused significant flooding in the central and eastern counties in Pennsylvania with wind damage that caused utility outages for 1-2 days. Then, Hurricane Irene caused flooding with utility interruptions for 5-8 days. 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. Hurricane Sandy caused significant wind damage and utility interruptions for between eight and ten days. The Poconos was the most directly hit area in Monroe County. Hurricane Sandy ranks among the most damaging coastal storms to ever hit the Poconos and Monroe County. In the 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 has assessed 200 structure, including mobile homes, single family homes and businesses for property damage. The estimated storm-recovery costs total between \$70 to \$80 million. This number includes all labor, housing, materials/equipment, and feeding expanded 24/7 staff for more than a week.

Table 30 - History of Coastal Storms Impacting Monroe County

History of Coastal Storms Impacting Monroe County			
Year	Name	Type	Approximate Speed (Knots) at Time of County Impact
1952	Able	Tropical Storm	50
1954	Hazel	Extratropical Storm	70
1955	Diane	Tropical Storm	45
1955	Connie	Tropical Storm	45
1959	Gracie	Extratropical Storm	25
1968	Candy	Extratropical Storm	25
1971	Doria	Tropical Storm	45
1972	Agnes	Tropical Storm	55
1979	David	Tropical Storm	40

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

History of Coastal Storms Impacting Monroe County			
Year	Name	Type	Approximate Speed (Knots) at Time of County Impact
1988	Chris	Extratropical Storm	20
1992	Danielle	Tropical Depression	25
1994	Beryl	Tropical Depression	15
1996	Bertha	Tropical Storm	60
1999	Dennis	Tropical Depression	20
1999	Floyd	Tropical Storm	50
2004	Ivan	Tropical Depression	15
2005	Katrina	No County Impact	N/A
2006	Ernesto	Extratropical Storm	25
2011	Lee	No County Impact	N/A
2011	Irene	Tropical Storm	55
2012	Sandy	Extratropical Storm	55
2016	Matthew	No County Impact	N/A
2017	Harvey	No County Impact	N/A
2017	Irma	No County Impact	N/A
2017	Nate	Extratropical Storm	25
2018	Florence	Extratropical Storm	25
2020	Fay	Tropical Storm	35
2020	Isaias	Tropical Storm	55
2021	Henri	Tropical Depression	25
2021	Ida	Extratropical Storm	35

4.3.4.4 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 31 - 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 91.59 % probability each year that Monroe County will experience winds from coastal storms that could cause minimal to moderate damages (*Table 31 - Annual Probability of Wind Speeds*). The probability of winds exceeding 118 mph is less than 8.32% annually.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 31 - Annual Probability of Wind Speeds

Annual Probability of Wind Speeds		
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
Source: FEMA, 2000		

There has been an increase in North Atlantic hurricane activity since the 1970s with locations of peak intensity tropical cyclones migrating poleward coinciding with tropics expansion. An index potential hurricane destructiveness suggests an increase over the past thirty years. Variability in tropical cyclone activity in the Atlantic is due to natural variability in ocean circulation, volcanic eruptions, and Saharan dust, as well as climate change resulting from greenhouse gases and sulfate aerosols.

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 tropical storms/hurricanes can also linger around for a longer period in each 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 seeing more 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, all which impact the future of Monroe County.

4.3.4.5 Vulnerability Assessment

The impacts of climate change are tangible and hazardous realities. Tropical storms tracking nearby Monroe County can not only cause high winds, but also heavy rains to occur. A vulnerability assessment for hurricanes and tropical storms focusses on the impacts of flooding and severe winds. Flooding associated with hurricanes/tropical storms can occur in areas

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

throughout Monroe County, which can cause damage to buildings and infrastructure. The assessment for flood-related vulnerability is addressed in Section 4.3.3.5 and a discussion of wind related vulnerability is addressed in Section 4.3.7.5. Due to the impact of hurricanes and tropical storms, the vulnerability for Monroe County is moderate. Potential economic losses could include direct building loss and business interruption. Direct building loss is direct damage to any building or structure. Business interruption includes relocation, employee wage loss, expenses, income loss, etc. Monroe County vulnerability level is moderate for direct building loss. The total direct building loss amount for Monroe County equates to \$148,330,000.00. The total business interruption value for Monroe County equates to \$277,110,000.00. Therefore, the vulnerability of direct building loss and business interruption is moderate.

As seen in *Table 3 – Population Change in Monroe County*, thirteen of the twenty municipalities in Monroe County have experienced a population loss since the previous decennial census in 2010. However, nine municipalities saw minor, total population growth over the same period. Based on this information, it can be speculated that these nine municipalities may have an increased vulnerability of hurricane and tropical storm conditions, since 2010, due to the increase in population.

Hurricanes and tropical storms may disproportionately affect underserved, unserved, and socially vulnerable populations, amplifying existing hardships. Fragile infrastructure in these areas is more prone to damage, which can hinder evacuation and rescue efforts. Limited access to resources exacerbates challenges during and after the storms, from securing safe shelter to obtaining essential supplies. Vulnerable communities often lack financial resilience, facing prolonged economic setbacks as local businesses may suffer.

Municipalities with increased risk to hurricane and tropical storm:

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Delaware Water Gap Borough
- East Stroudsburg Borough
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Mount Pocono Borough
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stroud Township
- Stroudsburg Borough
- Tobyhanna Township
- Tunkhannock Township

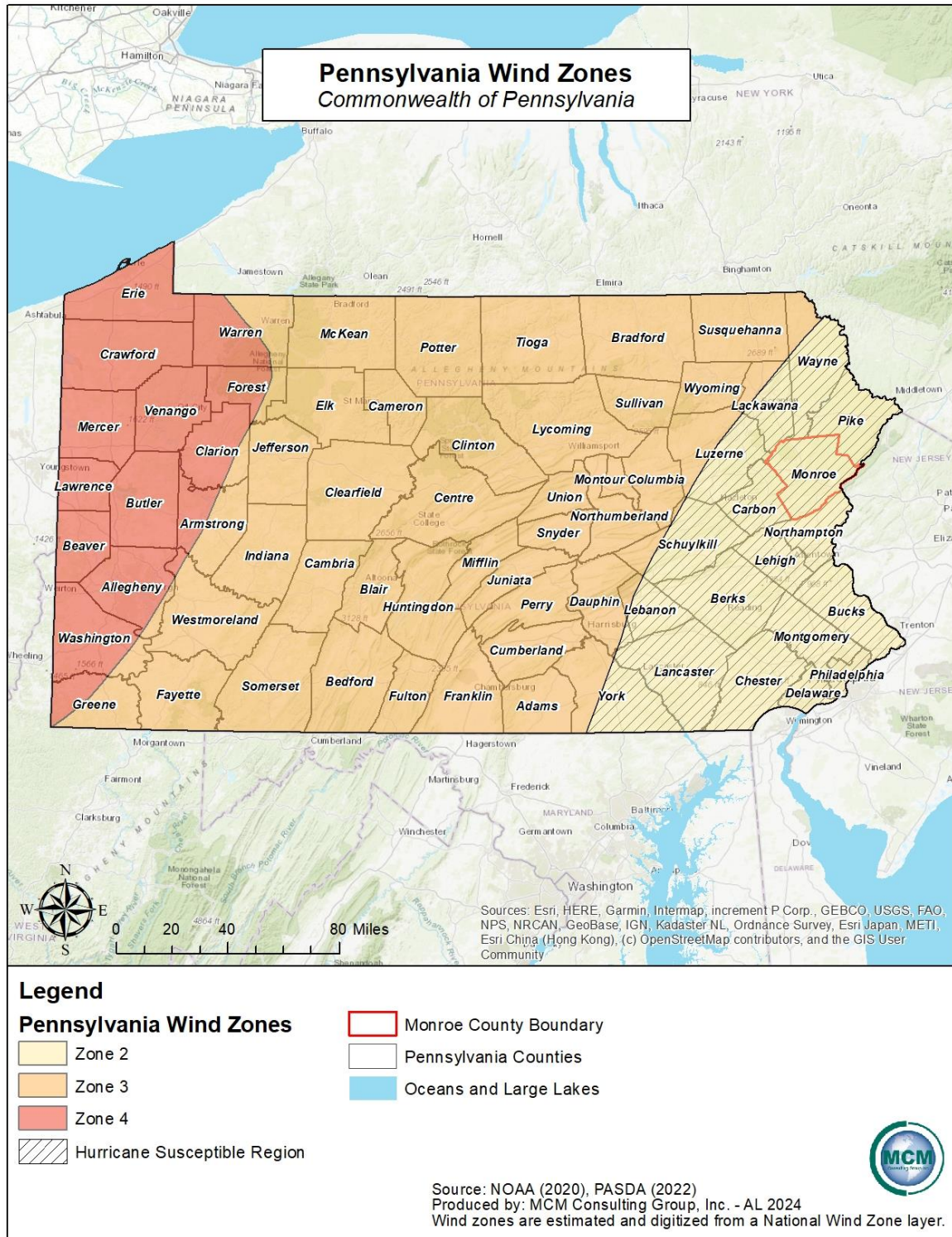
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Land use is a factor that has the potential to impact hurricane and tropical storm severity. Land use, in the form of a built environment, such as residential expansion, can cause hurricane impact severity to increase. This impact severity increases because as the built environment expands and becomes more complex, the impact the event will have on that area also increases. This is due to an influx of people, infrastructure, and critical infrastructure and community lifelines in harm's way.

Hurricanes and tropical storms exert profound impacts on both natural and cultural areas. Ecologically, these intense weather events can result in habitat destruction, altering landscapes, and threatening biodiversity. Erosion and flooding may harm delicate ecosystems. Culturally, these storms endanger heritage sites, historic structures, and artifacts, eroding tangible, and intangible cultural elements. Sustainable recovery efforts must embrace an integrated approach, recognizing the interconnected vulnerability of natural, historical, and cultural landscapes to the formidable forces of hurricanes and tropical storm.

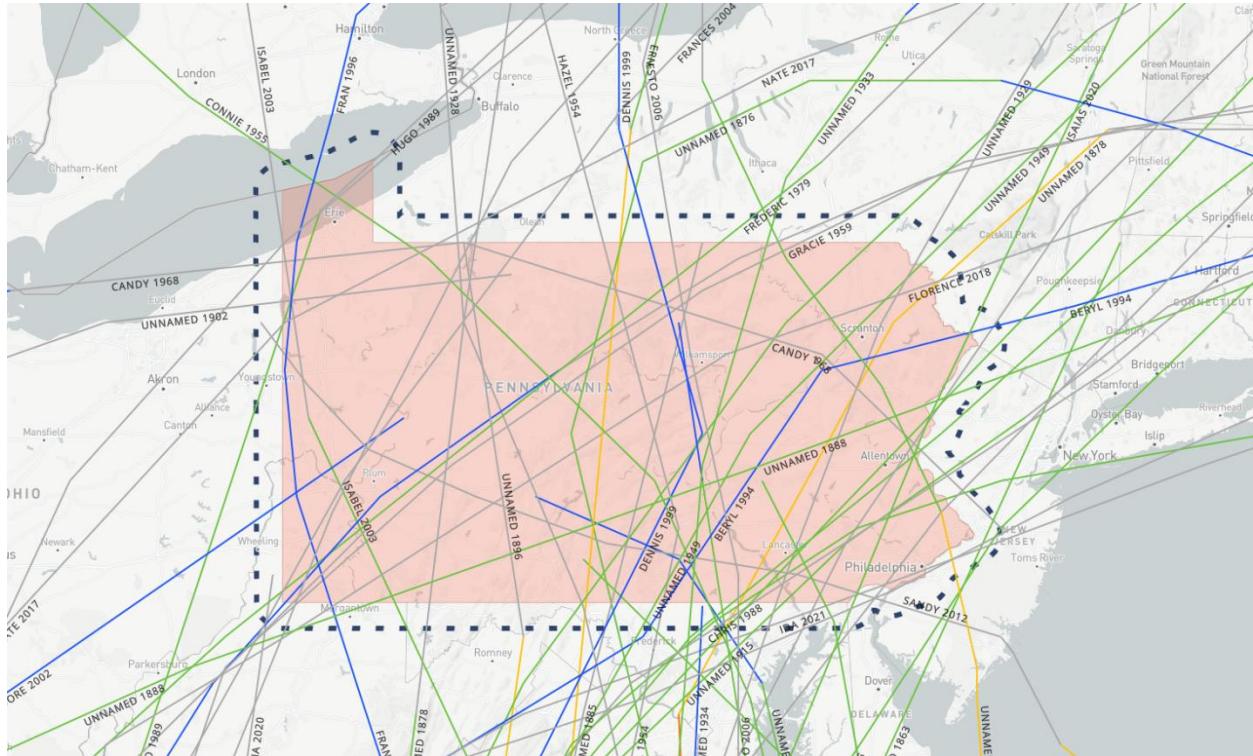
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Figure 17 - Pennsylvania Wind Zones



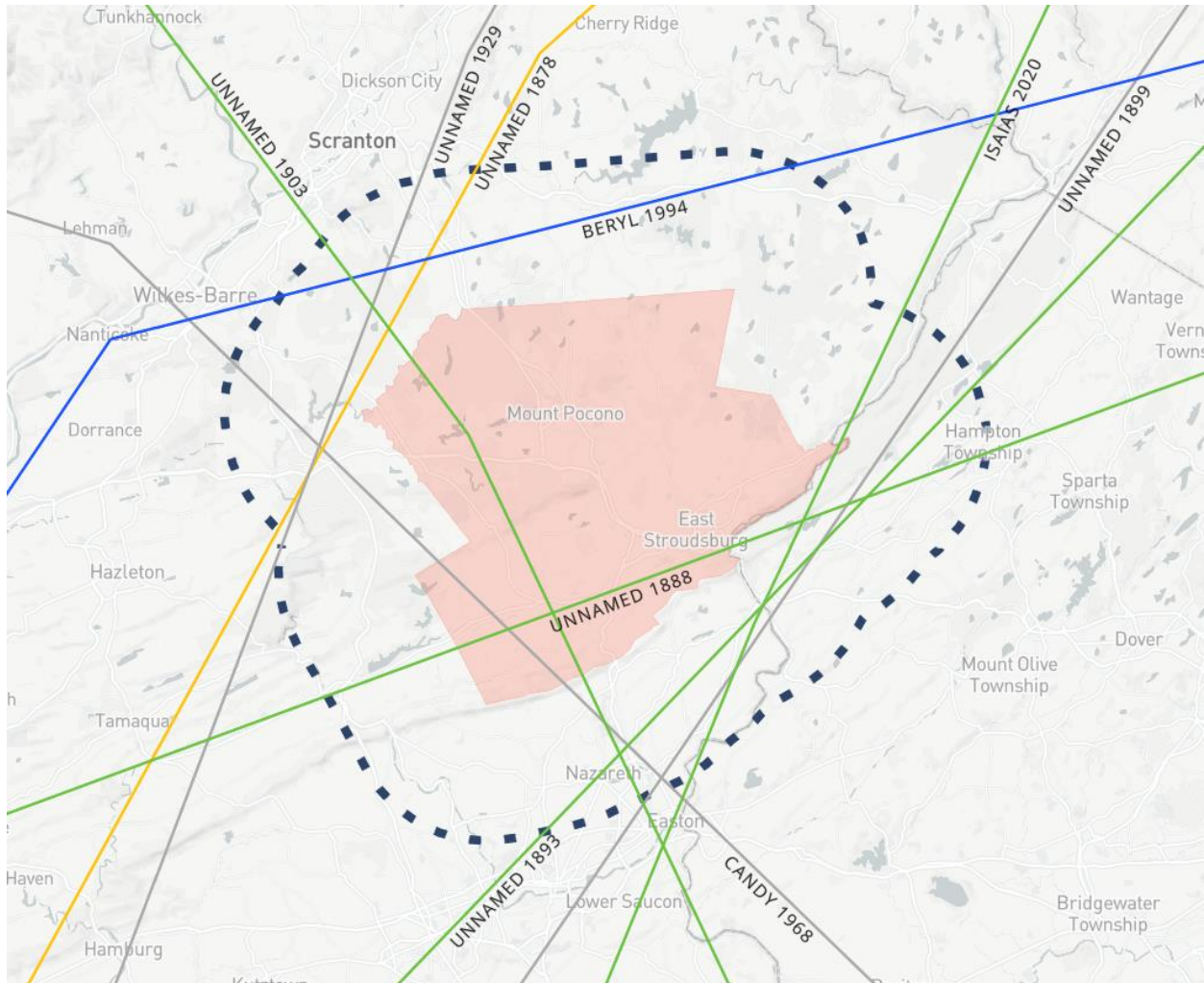
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Figure 18 - Historic Tropical Storms/Hurricanes in Pennsylvania



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 19 - Monroe County Hurricane Impacts



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.5. Invasive Species

4.3.5.1 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. Often, an invasive species spreads and reproduces quickly. Invasive species are not limited to organisms that come from a foreign country. Invasive species can come from a different region in the United States. The main instigator of invasive species is 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

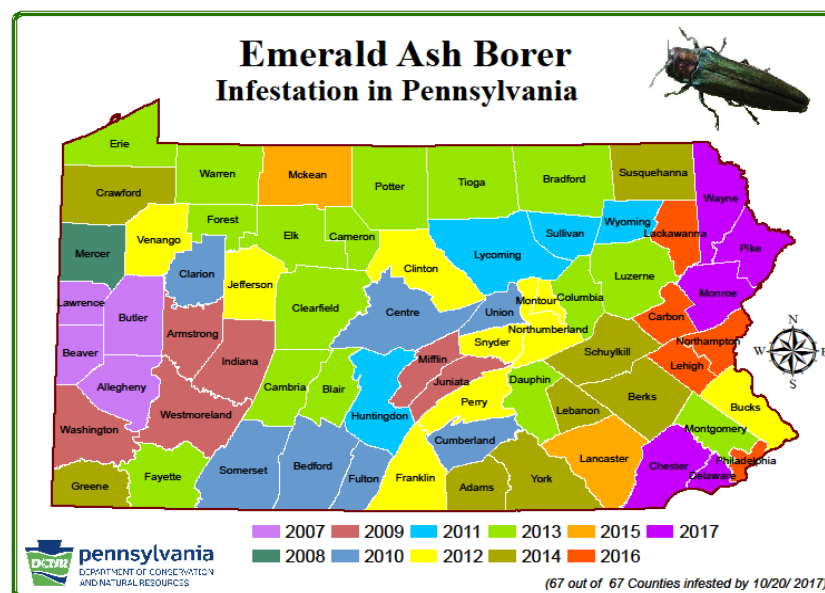
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

aggressive vascular plant. With wide ecological parameters and ease of spread, the vine is a more widespread invasive species threat. Other species' spread, such as the spotted lantern fly, has been limited by state agency activity. First discovered in Berks County in 2014, the spotted lantern fly was placed under a quarantine by the Pennsylvania Department of Agriculture in thirteen counties. *Table 32 - Prevalent Invasive Species* lists invasive species that have been found in Monroe County.

4.3.5.2 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 in 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 in Pennsylvania is the Emerald Ash Borer in Monroe County and the surrounding region (see *Figure 20 - Emerald Ash Borer Infestation in Pennsylvania*).

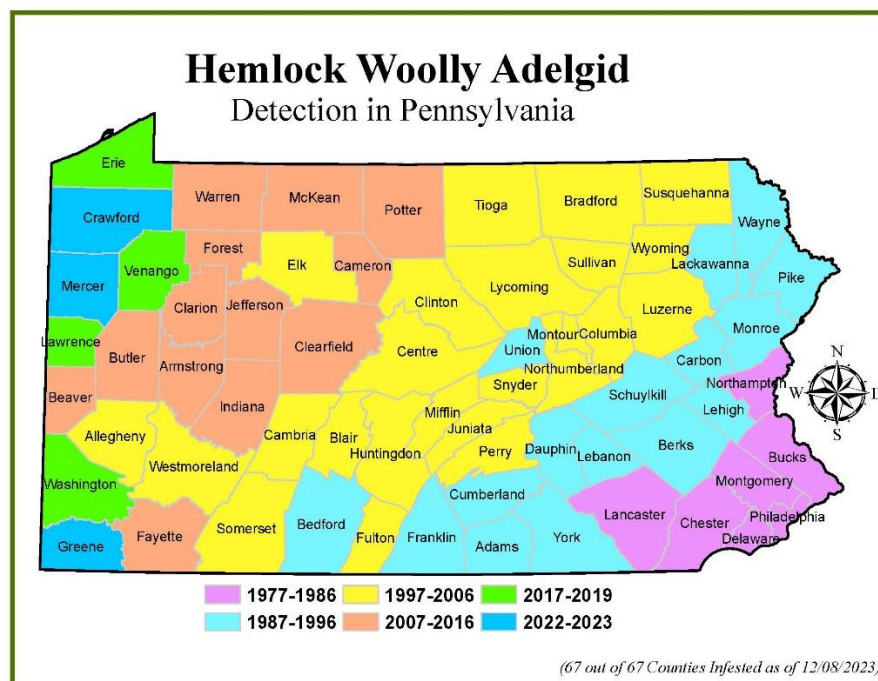
Figure 20 - Emerald Ash Borer Infestation in Pennsylvania



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Another example of an 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 is likely to have been introduced into the northeastern United States in the 1950s, and it was first discovered in Pennsylvania in 1967. To date, all sixty-seven counties in Pennsylvania, including Monroe County, have been infested with this insect. See *Figure 21 - Hemlock Woolly Adelgid Infestation in Pennsylvania*. Currently, Crawford, Mercer, and Greene counties are the three counties in the Commonwealth not reporting an infestation. 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 21 - Hemlock Woolly Adelgid Infestation in Pennsylvania



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

A final example of an invasive species is the Spotted Lanternfly. The Spotted Lanternfly is a harmful invasive species, which feeds on plants, damaging or destroying them. This can negatively impact the areas of Pennsylvania known for outdoor scenery and activities. 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 in 2018 and has undoubtedly continued to spread since that time. The State Department of Agriculture gives the total number of infected counties as fifty-one, as of 2024. *Figure 22 – Pennsylvania Spotted Lanternfly Infestation* illustrates the counties in Pennsylvania that are considered to be in the quarantine zone for this pest.

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.

4.3.5.3 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 38, 127, 129, 168, 186, 221, 312, and 318, as well as other areas in the county that have significant amounts of forest land and lakes, which species may 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 County include:

- Emerald Ash Borer
- Spotted Lantern Fly
- Hemlock Woolly Adelgid

Many of the extreme problematic species have been around for many years. However, the most recent problematic species are the Emerald Ash Borer, Hemlock Woolly Adelgid, and the Spotted Lanternfly. In 2007, both the Emerald Ash Borer and Hemlock Woolly Adelgid were both newly spotted species that caused extreme damage. Even more recently than 2007, the Spotted Lanternfly appeared in Monroe County.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Table 32 - Prevalent Invasive Species lists problematic, non-native species that have been documented in Monroe County.

Table 32 - Prevalent Invasive Species

Prevalent Invasive Species (iMapInvasives, 2024; PA DCNR, 2024)		
Common Name	Scientific Name	Type
Asiatic Clam	Corbicula fluminea	Animal
Autumn Olive	Elaeagnus umbellata	Plant
Beech Lead Nematode	Litylenchus crenatae mccannii	Animal
Bishop's Goutweed	Aegopodium podagraria	Plant
Black Swallow-wort	Cynanchum louiseae	Plant
Bohemian Knotweed	Reynoutria x bohemica	Plant
Bouncing-bet	Saponaria officinalis	Plant
Broadleaf Water-milfoil	Myriophyllum heterophyllum	Plant
Burning Bush	Euonymus alatus	Plant
Carolina Fanwort	Cabomba caroliniana	Plant
Carpet-bugle	Ajuga reptans	Plant
Chinese Mysterysnail	Cipangopaludina chinensis	Animal
Climbing Nightshade	Solanum dulcamara var. dulcamara	Plant
Colonial Bentgrass	Agrostis capillaris	Plant
Colt's-foot	Tussilago farfara	Plant
Common Carp	Cyprinus carpio	Animal
Common Mullein	Verbascum thapsus	Plant
Common Reed	Phragmites australis ssp.	Plant
Common Speedwell	Veronica officinalis	Plant
Curly-leaf Pondweed	Potamogeton crispus	Plant
Cypress Spurge	Euphorbia cyparissias	Plant
Dame's Rocket	Hesperis matronalis	Plant
Didymo	Didymosphenia geminata	Animal
Eastern Helleborine	Epipactis helleborine	Protist
Elongate Hemlock Scale	Fiorinia externa	Animal
Emerald Ash Borer	Agrilus planipennis	Animal
Eurasian Water-milfoil	Myriophyllum spicatum	Plant
Field Garlic	Allium vineale	Plant
Floating Bladderwort	Utricularia inflata	Plant
Freshwater Jellyfish	Craspedacusta sowerbyi	Animal
Garden Bird's-foot-trefoil	Lotus corniculatus	Plant
Garlic Mustard	Alliaria petiolata	Plant

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Prevalent Invasive Species (iMapInvasives, 2024; PA DCNR, 2024)		
Common Name	Scientific Name	Type
Glossy False Buckthorn	Frangula alnus	Plant
Goldfish	Carassius auratus	Animal
Greater Celandine	Chelidonium majus	Plant
Ground-ivy	Glechoma hederacea	Plant
Hemlock Woolly Adelgid	Adelges tsugae	Animal
Honeysuckle	Lonicera spp	Plant
Hydrilla	Hydrilla verticillata	Plant
Japanese Barberry	Berberis thunbergii	Plant
Japanese Knotweed	Reynoutria japonica var. japonica	Plant
Japanese Stiltgrass	Microstegium vimineum	Plant
Jumping Worms	Amyntas-Metaphire spp.	Animal
Knotweed	Reynoutria spp.	Plant
Lady's Thumb	Persicaria maculosa	Plant
Lesser Celandine	Ranunculus ficaria	Plant
Meadow Timothy	Phleum pratense	Plant
Mile-a-minute vine	Persicaria perfoliata	Plant
Morrow's Honeysuckle	Lonicera morrowii	Plant
Mudmat	Glossostigma cleistanthum	Plant
Mugwort	Artemisia vulgaris	Plant
Multiflora Rose	Rosa multiflora	Plant
Mute Swan	Cygnus olor	Animal
Northern Snakehead	Channa argus	Animal
Norway Maple	Acer platanoides	Plant
Orange Hawkweed	Hieracium aurantiacum	Plant
Oriental Bittersweet	Celastrus orbiculatus	Plant
Poison-hemlock	Conium maculatum	Plant
Pond Water-starwort	Pond Water-starwort	Plant
Purple Loosestrife	Lythrum salicaria	Plant
Red Swamp Crayfish	Procambarus clarkii	Animal
Red-eared Slider	Trachemys scripta elegans	Animal
Sheep Sorrel	Rumex acetosella	Plant
Slider	Trachemys scripta	Animal
Spotted Lantern Fly	Lycorma delicatula	Animal
Sweet Vernal Grass	Anthoxanthum odoratum	Plant
Sweetflag, Calamus	Acorus calamus	Plant
Tree-of-Heaven	Ailanthus altissima	Plant

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Prevalent Invasive Species (iMapInvasives, 2024; PA DCNR, 2024)		
Common Name	Scientific Name	Type
True Forget-me-not	<i>Myosotis scorpioides</i>	Plant
Wall-lettuce	<i>Mycelis muralis</i>	Plant
Water Chestnut	<i>Trapa natans</i>	Plant
Watercress	<i>Rorippa nasturtium-aquaticum</i>	Plant
White Moth Mullein	<i>Verbascum blattaria</i>	Plant
Wild Basil	<i>Clinopodium vulgare</i>	Plant
Yellow Iris	<i>Iris pseudacorus</i>	Plant
Yellow-bellied Slider	<i>Trachemys scripta scripta</i>	Animal

4.3.5.4 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 unknown 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, and 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 33 – Future Vulnerable 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, so prevention is very important. The development of appropriate plans will assist the county in reducing the possibility of a future encounter with any of these species. Working toward keeping these species from entering the area would be beneficial to the forests of Monroe County.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Climate change and its relationship with invasive species has a major correlation. According to the U.S Geological Survey, climate change has been creating a new pathway for invasive species to be introduced into the environment. As an example, the rise in temperature allows existing invasive species to expand their geographic area. Also, climate change hinders the tools for eliminating invasive species.

Table 33 - Future Vulnerable Species

Future Vulnerable Species (PA DCNR, 2024; iMapInvasives, 2024)		
Scientific Name	Common Name	Type
Allegheny Crayfish	Faxonius obscurus	Animal
Alsike Clover	Trifolium hybridum	Plant
Asiatic Dayflower	Commelina communis	Plant
Bamboo	Phyllostachys spp.	Plant
Beech Scale	Cryptococcus fagisuga	Animal
Black Locust	Robinia pseudoacacia	Animal
Black Medic	Medicago lupulina	Plant
Broadhead Planarians	Bipalium spp.	Plant
Buckthorn	Rhamnus cathartica	Plant
Bull Thistle	Cirsium vulgare	Plant
Butter-and-eggs	Linaria vulgaris	Plant
Canada Bluegrass	Poa compressa	Plant
Carter's Moss Animal	Lophopodella carteri	Animal
Chicory	Cichorium intybus	Plant
Chinese Silver Grass	Miscanthus sinensis	Plant
Chinese Wisteria	Wisteria sinensis	Plant
Common Crown-vetch	Coronilla varia	Plant
Common Frogbit	Hydrocharis morsus-ranae	Plant
Common Morning-glory	Ipomoea purpurea	Plant
Common Velvetgrass	Holcus lanatus	Plant
Common Water-hyacinth	Eichhornia crassipes	Plant
Creeping Jenny	Lysimachia nummularia	Plant
Creeping Smartweed	Polygonum caespitosum var. longisetum	Plant
Elongate Hemlock Scale	Fiorinia externa	Animal
English Plantain	Plantago lanceolata	Plant
European Lily-of-the-valley	Convallaria majalis	Plant
European Speedwell	Veronica beccabunga	Plant
Flathead Catfish	Pylodictis olivaris	Animal

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Future Vulnerable Species (PA DCNR, 2024; iMapInvasives, 2024)		
Scientific Name	Common Name	Type
Floating Bladderwort	Utricularia inflata	Plant
Forget-me-not	Myosotis scorpioides	Plant
Gold-moss	Sedum acre	Plant
Great Hairy Willowherb	Epilobium hirsutum	Plant
Great Hedge Bedstraw	Galium mollugo	Plant
Green Sunfish	Lepomis cyanellus	Animal
Greenside Darter	Etheostoma blennioides	Animal
House Sparrow	Passer domesticus	Animal
Indian Mock Strawberry	Duchesnea indica	Plant
Japanese Brome	Bromus japonicus	Plant
Japanese Honeysuckle	Lonicera japonica	Plant
Japanese Hop	Humulus japonicus	Plant
Japanese-spurge	Pachysandra terminalis	Plant
Kentucky Bluegrass	Poa pratensis	Plant
Kentucky Fescue	Lolium arundinaceum	Plant
Lesser Burdock	Arctium minus	Plant
Lesser Periwinkle	Vinca minor	Plant
Mouse-ear Hawkweed	Hieracium pilosella	Plant
Mud Bithynia	Bithynia tentaculata	Animal
Musk Thistle	Carduus nutans	Plant
Mute Swan	Cygnus olor	Animal
Narrowleaf Cattail	Typha angustifolia	Plant
Nepal Smartweed	Persicaria nepalensis	Plant
Nepalese Browntop	Microstegium vimineum	Plant
New Zealand Mudsail	Potamopyrgus antipodarum	Animal
Northern Catalpa	Catalpa speciosa	Plant
Northern Snakehead	Channa argus	Animal
Oakleaf Goosefoot	Chenopodium glaucum	Plant
Orange-eye Butterfly-bush	Buddleja davidii	Plant
Oxeye Daisy	Leucanthemum vulgare	Plant
Perennial Pea	Lathyrus latifolius	Plant
Pond Water-starwort	Callitriche stagnalis	Plant
Porcelain Berry	Ampelopsis brevipedunculata	Plant
Poverty Brome	Bromus sterilis	Plant
Princess Tree	Paulownia tomentosa	Plant
Privet	Ligustrum spp.	Plant

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Future Vulnerable Species (PA DCNR, 2024; iMapInvasives, 2024)		
Scientific Name	Common Name	Type
Quagga Mussel	Dreissena bugensis	Animal
Queen Anne's Lace	Daucus carota	Plant
Rainbow Smelt	Osmerus mordax	Plant
Reed Canary Grass	Phalaris arundinacea	Plant
Rock Pigeon	Columba livia	Animal
Rusty Crayfish	Faxonius rusticus	Animal
Scribner's Bluegrass	Poa trivialis	Plant
Sea Lamprey	Petromyzon marinus	Animal
Slender Cottonweed	Froelichia gracilis	Plant
Smooth Brome	Bromus inermis	Plant
Spongy Moth	Lymantria dispar	Animal
Spotted Cat's-ear	Hypochaeris radicata	Plant
Spotted Starthistle	Centaurea stoebe ssp. micranthos	Plant
Sweet Cherry	Prunus avium	Plant
Sweetclover	Melilotus officinalis	Plant
Sycamore Maple	Acer pseudoplatanus	Plant
Three-stamen Waterwort	Elatine triandra	Plant
Water Lettuce	Pistia stratiotes	Plant
White Clover	Trifolium repens	Plant
White Mulberry	Morus alba	Plant
White River Crayfish	Procambarus acutus	Animal
Wild Parsnip	Pastinaca sativa	Plant
Wild Teasel	Dipsacus fullonum	Plant
Wineberry	Rubus phoenicolasius	Plant

4.3.5.5 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 389,376 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 County, a negative impact could 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 have all been identified in red in *Table 32 - Prevalent Invasive Species for priority species in Monroe County*.

Due to 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.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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 33 – Future Vulnerable Species*). Public outreach and education are important to increase knowledge of 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.

All of the socially vulnerable populations in Monroe County are at an increased vulnerability to invasive species. The homeless and the unsheltered populations are at risk due to not having a structure to reside in. Also, the economically vulnerable of Monroe County may not have the capability to fix or hire pest control if their homes are damaged or overrun by invasive species.

As seen in *Table 3 – Population Change in Monroe County*, nine municipalities have seen a net population increase from the 2010 decennial census to the 2020 decennial census. Based on this information, it can be speculated that these municipalities may have an increased risk to invasive species, since 2010, due to the increase in population and construction.

The historic properties in Monroe County are at different levels of vulnerability to invasive species. Most of the historic properties in Monroe County are made of brick and masonry construction and are at a lower risk of vulnerability from invasive species. There are approximately ten buildings that are historic in Monroe County that are of brick and masonry construction. Five historic properties are made of stone and could be damaged by invasive species, but it is low.

Land use changes in Monroe County could be a factor in the potential impact invasive species have on native species. Land use is a major factor with the severity of invasive species. Land use, in the form of a built environment, such as residential expansion, can cause invasive species impact severity to increase. Impact severity increases because as the built environment expands and becomes more complex, the impact the event will have on that area also increases because there is an influx of people, infrastructure, and critical infrastructure in the hazard area.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

According to Smithsonian Environmental Research Center, invasive species thrive on major land use disturbances, as an example the logging of a forest or flooding to a wetland can create conditions that invasive species thrive on to move into a specific area.

Invasive species in Monroe County pose a significant threat to infrastructure systems through various mechanisms. Invasive plants like kudzu or Japanese knotweed can damage infrastructure such as roads, bridges, and buildings by infiltrating cracks and causing structural damage. Their aggressive growth can also obstruct drainage systems, leading to flooding and erosion, thus compromising the integrity of roads and bridges.

Invasive animals, such as feral hogs or zebra mussels, can disrupt infrastructure by burrowing into embankments, weakening them and increasing the risk of collapse. Additionally, animals like rodents or insects may gnaw on electrical wiring and utility cables, leading to malfunctions or even fires, posing risks to both infrastructure and public safety.

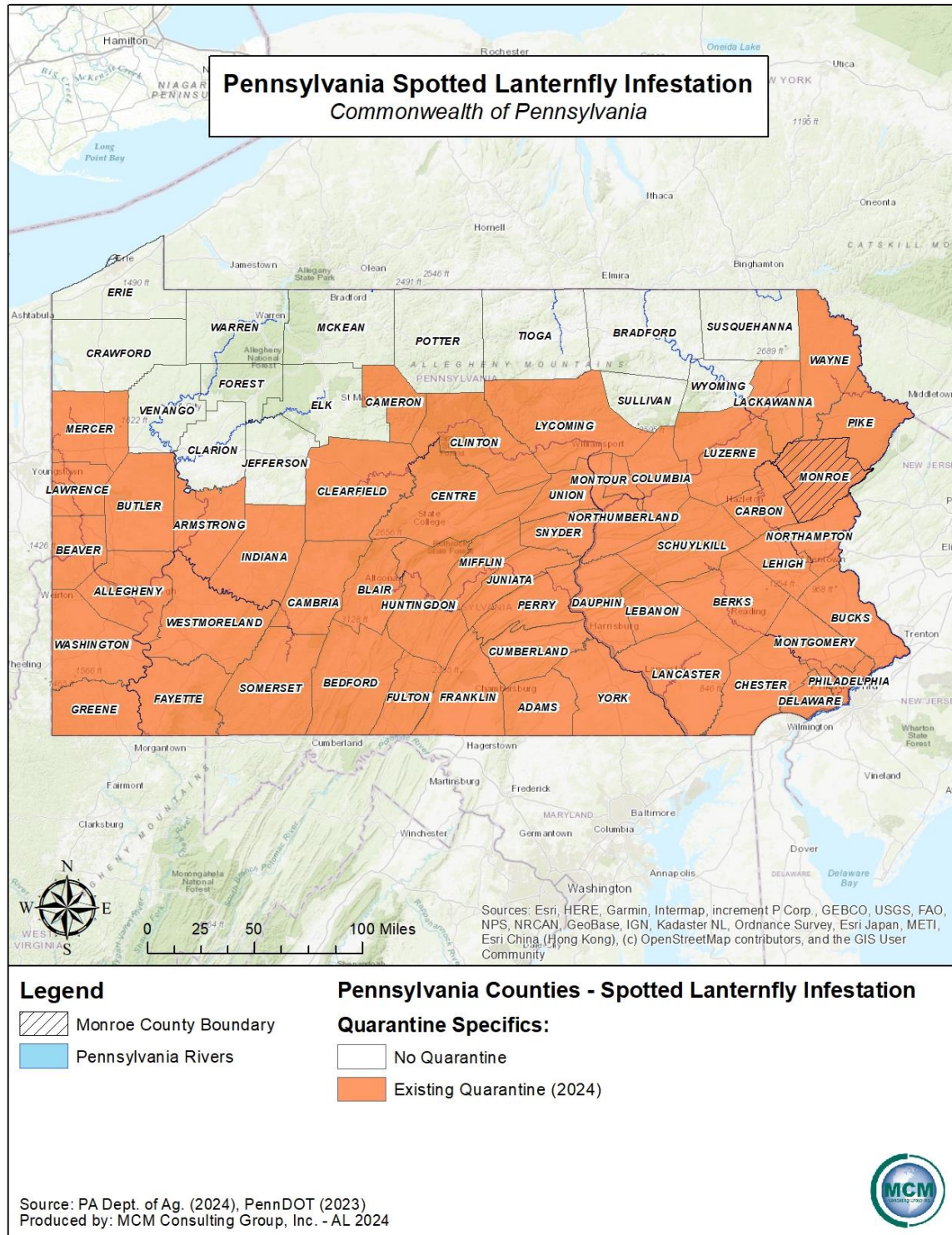
Furthermore, invasive species can interfere with transportation systems by clogging waterways. For example, invasive aquatic plants can impede navigation channels, necessitating costly scouring operations. Invasive insects like the emerald ash borer can devastate tree populations, including those lining roads or railways, posing hazards from falling trees and impacting transportation routes.

The public outlined the following issues in the following municipalities. This information was collected as part of the county's outreach to the public at county events.

- Hamilton Township: The public identified that invasive species are present or have been present at natural areas near a portion of the Cherry Valley National Wildfire Refuge.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 22 - Pennsylvania Spotted Lanternfly Infestation



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.6. Pandemic, Epidemic, Endemic, and Infectious Disease

4.3.6.1 Location and Extent

Epidemic

An epidemic occurs when an infectious disease spreads more quickly than expected by medical and healthcare authorities. It is characterized by widespread growth or extent that spreads quickly and incurs a greater rate of novel or endemic cases than baseline estimates would initially project. When an epidemic occurs, it typically impacts a larger area than a localized outbreak. Epidemics often include multiple countries, although not always spreading to different continents. In short, epidemics are regional.

Pandemic

A pandemic is a disease outbreak that spreads across countries or continents, which affects the population of a vast area. When a pandemic occurs, the event usually affects more people and takes more lives than an epidemic. Pandemics are 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 frequently affect the United States. A pandemic is measured and defined by the spreading of a disease rather than the fatalities with which it is associated. The characteristics of a pandemic outbreak include large and rapid scale spread, overload of healthcare systems, inadequate medical supplies, disruption of economy/society, and medical supply shortages. While a pandemic may be characterized as a type of epidemic, an epidemic is not a type of pandemic. Additionally, pandemics travel more efficiently than epidemics. In the event that a pandemic occurs in the eastern United States, the entirety of Monroe County would likely be impacted.

Endemic

An endemic is described as a disease that is present in a community at all times but occurs in a relatively low frequency and is not spreading at a rapid rate. An endemic can be a previous pandemic such as influenza, or coronavirus (COVID-19), or a more regionalized virus such as Ebola virus in Africa. An endemic can become a pandemic if the disease mutates into a more virulent strain.

Infectious Disease

Infectious diseases are illnesses caused by pathogenic organisms such bacteria, viruses, fungi, or parasites. Organisms become harmful and cause disease under certain conditions. The sources of infectious disease may originate from contaminated food or waterways, infected

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

animals/livestock, or 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.

Pandemic and infectious disease events cover a wide geographical area and can affect large populations, potentially including the entire population of the Commonwealth of Pennsylvania. 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 more populated and urban 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 in, and contaminate, standing water.

4.3.6.2 Range of Magnitude

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, the West Nile virus produces clinically asymptomatic cases less than 80% of the time. Therefore, approximately 20% of the cases result in mild infection, also known as West Nile fever. Approximately 1% of West Nile Virus cases result in severe neuroinvasive infections (National Institute of Health: National Library of Medicine).

Pandemic influenza has a higher transmission rate from person-to-person compared to the West Nile virus. The West Nile Virus has no person to person transmission with the exception of from a pregnant mother to a child. Advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. In the early 1900s, flu pandemics historically caused tens of millions of deaths, while the 2009 Novel H1N1, known as swine flu, caused fewer than 20,000 deaths world-wide. Many people infected with swine flu in 2009 recovered without needing medical treatment. Without recent medical inventions and technologies, modern influenza would be associated with higher morbidity rates. 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 were much higher than any previous outbreaks related to other members of the coronavirus family such as SARS-CoV and MERS-CoV.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

In the past 100 years, humanity did not face a microbial pandemic similar in scale to the COVID-19 pandemic. The worldwide transmission rate of COVID-19 from human to human rapidly advanced in 2020 and 2021. Of the six global outbreaks of viral infections, three were caused by coronaviruses (SARS, MERS, and COVID-19).

While there are limited secondary hazards related to public health emergencies, an outbreak can cause a variety of cascading hazards. Civil disorder due to supply shortages is the most common cascading hazard to result from pandemic, epidemic, or infectious disease. Additional potential effects could include: a shortage of medical supplies and personnel, hoarding of household paper and cleaning supplies, school and business disruption, government closings, government restrictions on travel, low attendance at places of employment, slowed productivity, and widespread economic instability.

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. These phases of alert systems were used during the COVID-19 pandemic. These phases are listed below in *Table 34 - Pandemic Influenza Phases*.

Table 34 - 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.
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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Pandemic Influenza Phases	
Phase	Characteristics
	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 influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.
Source: WHO, 2009	

4.3.6.3 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 35 - Past Pandemic Events in the United States* illustrates the various past pandemic events that have occurred since the late 1800's. Prior to COVID-19, 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 being the most current and having the highest transmission rates. Municipalities in Monroe County indicated a decrease in the pandemic and infectious disease section of the risk factor assessment municipal comparison.

Spanish Flu

An estimated 1/3 of the world's population was infected and had clinically apparent illnesses during the 1918 - 1919 influenza pandemic. Pennsylvania experienced severe effects from the Spanish Flu. It claimed 500,000 lives in the United States, which included individuals in Monroe County. There is a lack of data which provides exact numbers of deaths that occurred in Monroe County from the Spanish Flu, however there were a total of 60,000 deaths in Pennsylvania. Deaths occurring in Monroe County are included in this number. There were approximately 47,000 reported cases and 12,000 deaths in Philadelphia in just over four weeks. In the first six months, there were about half a million cases and 16,000 deaths of the Spanish Flu in

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Philadelphia. The factors of high population density including crowded and unhygienic conditions contributed to higher numbers of cases and death rates across Pennsylvania.

Swine Flu/Avian Flu/H1N1

Each year, different strains of influenza are labeled as potential pandemic threats. 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.

Monroe County was impacted by the H1N1 virus during 2009. The Pennsylvania Department of Health (PA DOH) set up clinics throughout the county to administer vaccines to at-risk populations. A total 10,940 cases and seventy-eight deaths occurred in Pennsylvania from this pandemic but there is insufficient data to determine the exact number of cases and deaths from swine flu in Monroe County.

COVID-19

Monroe County was directly impacted by the COVID-19 pandemic. As of June 2023, Pennsylvania had an estimated 3.5 million total cases and 54,329 deaths related to the COVID-19 pandemic. 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 in March 2020. Beginning in December of 2020, there was a large-scale vaccination effort to combat COVID-19.

Table 35 - 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 pandemic events, but the county has also experienced infectious disease events. The two major infectious diseases prevalent throughout Monroe

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

County and Pennsylvania as a whole are the West Nile Virus and Lyme Disease. Due to the climatic traits of Pennsylvania these infectious diseases thrive in Monroe County. Both diseases are transmitted by arthropod vectors, which are abundant throughout Monroe 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. By 2003, all counties in the Commonwealth had confirmed cases. A comprehensive network has been developed in Pennsylvania that includes trapping mosquitoes, conducting mosquito control treatments, collecting dead birds, and monitoring horses, people and, in past years, sentinel chickens. Monroe County has conducted over 120 mosquito control treatments in 2024 within the county. Although West Nile Virus positive cases are few in Monroe County, 2021 had the most positive cases in Monroe County since 2019. Over the past five years, one human has tested positive for West Nile Virus in Monroe County. *Table 36 - West Nile Virus Control Program in Monroe County Since 2019* outlines the West Nile Virus within Monroe County from 2019 to 2023. The number of total positive cases for West Nile Virus in Monroe County are the same for calendar year 2021 and calendar year 2024.

Table 36 - West Nile Virus Control Program in Monroe County since 2019

West Nile Virus Control Program in Monroe County Since 2019				
Year	Total Positives	Human Positives	Mosquito Positives	Bird Positives
2024	20	0	20	0
2023	15	0	15	0
2022	12	0	12	0
2021	20	0	20	0
2020	5	1	4	0
2019	4	0	0	4
Source: PA Department of Environmental Protection, 2023				

Lyme Disease

Lyme Disease has been present in the United States and Monroe County for many years. More wooded areas have higher cases due to ticks being the main biological vector. Lyme disease is found in all sixty-seven counties within Pennsylvania. Monroe County has an overall approximately 1,910 confirmed cases of Lyme disease from 2000 until 2020, although actual totals may be significantly higher due to under reporting. Monroe County as a whole has a moderately high positive total for Lyme Disease in the county, especially over the past several

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

years. It is possible that numbers have risen dramatically due to lack of testing in previous years. Monroe County experienced the highest number of positive cases in 2017 and 2019. Lyme disease case counts have been consistently rising over the past several years. It should be noted that information represented for each county may vary due to reporting practices. Hence these figures represent a rough estimate of the Lyme disease burden in Monroe County. *Table 37 - Lyme Disease Data for Monroe County* outlines the total positive cases of Lyme Disease within Monroe County since 2000 to 2023 for ticks that have tested positive with Tick Check.

Table 37 - Lyme Disease Data for Monroe County

Lyme Disease Data for Monroe County	
Year	Total Positives
2000	19
2001	49
2002	75
2003	93
2004	61
2005	77
2006	22
2007	31
2008	112
2009	133
2010	59
2011	88
2012	70
2013	92
2014	102
2015	131
2016	137
2017	175
2018	105
2019	166
2020	113
2021	88
2022	79
2023	98
Source: PA Tick Check, 2020	

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Zika Virus

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.

Eastern Equine Encephalitis

Eastern equine encephalitis is an additional infectious disease that is spread by mosquito bites in areas of acidic swamp, including areas that are commonly found in the Poconos and Monroe County. The CDC outlines that eastern equine encephalitis is rare but is also a serious infectious disease with approximately 30% of those who contract the virus dying from the disease (CDC, 2025). This is a low infection rate but a moderately high mortality rate. Not only is this a concern for Monroe County, but it is also a concern for adjacent counties in the Poconos. The direct illness for eastern equine encephalitis can include fever, headache, vomiting, diarrhea, seizures, behavioral changes, and drowsiness (CDC, 2025).

4.3.6.4 Future Occurrence

Pandemic & Epidemic

The probability of a widespread public health emergency effecting Monroe County is approximately once every ten years. Minor outbreaks of less serious communicable disease, such as influenza, will occur much more frequently. The occurrence of pandemic influenza outbreaks is unpredictable, and complete avoidance of the events is unlikely. Therefore, future occurrences of pandemics and infectious disease events are very likely. Pandemics may also emerge from other diseases, especially invasive pathogens for which Monroe County and Pennsylvania as a whole lack natural immunity.

Influenza

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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Infectious Disease

Infectious diseases such as West Nile Virus and Lyme Disease have been present in Monroe County for many years and are expected to perpetuate. The best way to prevent infectious disease outbreaks, including West Nile Virus and Lyme Disease, is to actively address the causes of the diseases. West Nile Virus occurrence can be reduced by removing mosquito breeding locations in stagnant water sources and Lyme Disease occurrence can be reduced by utilizing insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitats. Occurrence of Zika Virus can also be reduced by removing mosquito breeding areas and areas of stagnant water. Both West Nile Virus and Lyme Disease are expected to continue occurring in Monroe County in the future.

Climate change can result in a wider range of pandemic, epidemics, and infectious diseases that can impact larger areas of the globe. As climate change continues to occur, more populations have the potential to come into contact with vectors for diseases. The migration of animals could also increase vulnerability to this hazard for populations in Monroe County. Climate change is discussed below in Section 4.3.6.5.

4.3.6.5 Vulnerability Assessment

Monroe County is considered to be a moderate vulnerability county in regard to the pandemic events. It is extremely difficult to predict the occurrence and the magnitude of a pandemic or epidemic event. The COVID-19 pandemic disproportionately affected populations over the age of sixty-five, especially those in nursing homes. It has had disparate effect on socially vulnerable populations, including unsheltered and homeless individuals.

Elderly individuals, children and immune deficient individuals are the most vulnerable to disease. Nursing facilities, personal care facilities, daycares, schools, and hospitals are considered more vulnerable since there are often groups of these socially vulnerable individuals present at these community lifelines. 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 reported high numbers of cases and deaths, and several county jails and state correctional institutions reported wide community spread.

Health-care workers and those working in direct-care (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 who work outdoors for extended periods of time in warm months may be more vulnerable to West Nile Virus, Lyme Disease, or the Zika virus.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

The number of hospitals within the county, and availability of beds within the hospitals, determine the amount of care vulnerable and sick patients will receive. It is important for hospitals to review and exercise emergency response plans and continuity of operations plans (COOP) to ensure that there is an effective public health response.

All critical infrastructure facilities and community lifeline facilities are vulnerable to pandemic, epidemic, and infectious disease, due to the people working and operating those facilities being at an increased vulnerability based on location and dispersion of disease vectors. This includes all of the critical infrastructure in the county and the community lifelines, a total of 118 locations. This includes but is not limited to one hospital, five police stations, and twenty-nine fire stations. These locations are spaced evenly throughout the county but are clustered primarily in the boroughs of the county.

A pandemic can vastly impact historic resources by disrupting routine maintenance, leading to physical deterioration of structures and artifacts. The closure of cultural institutions, including museums and archives, hinders public access and educational activities. Economic downturns may reduce funding for preservation efforts, while a decline in tourism threatens the financial sustainability of historic sites. Community engagement may suffer if events and traditional practices are disrupted, affecting the transmission of cultural knowledge.

Municipalities with high risk due to pandemic, epidemic, and infectious diseases:

- All municipalities within Monroe County are at high risk for pandemic, epidemic, and infectious diseases

During a public health emergency, the PA DOH may open emergency medicine centers called points of dispensing (POD) 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.

POD are coordinated with county emergency managers by the PA DOH with the six regional healthcare districts (see *Figure 23 - Pennsylvania Department of Health Districts*). Monroe County is in the northeast region. At the time of the writing of this plan, POD were involved with mass vaccinations against COVID-19 and most POD have been shut down due to lack of high-demand for vaccinations.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

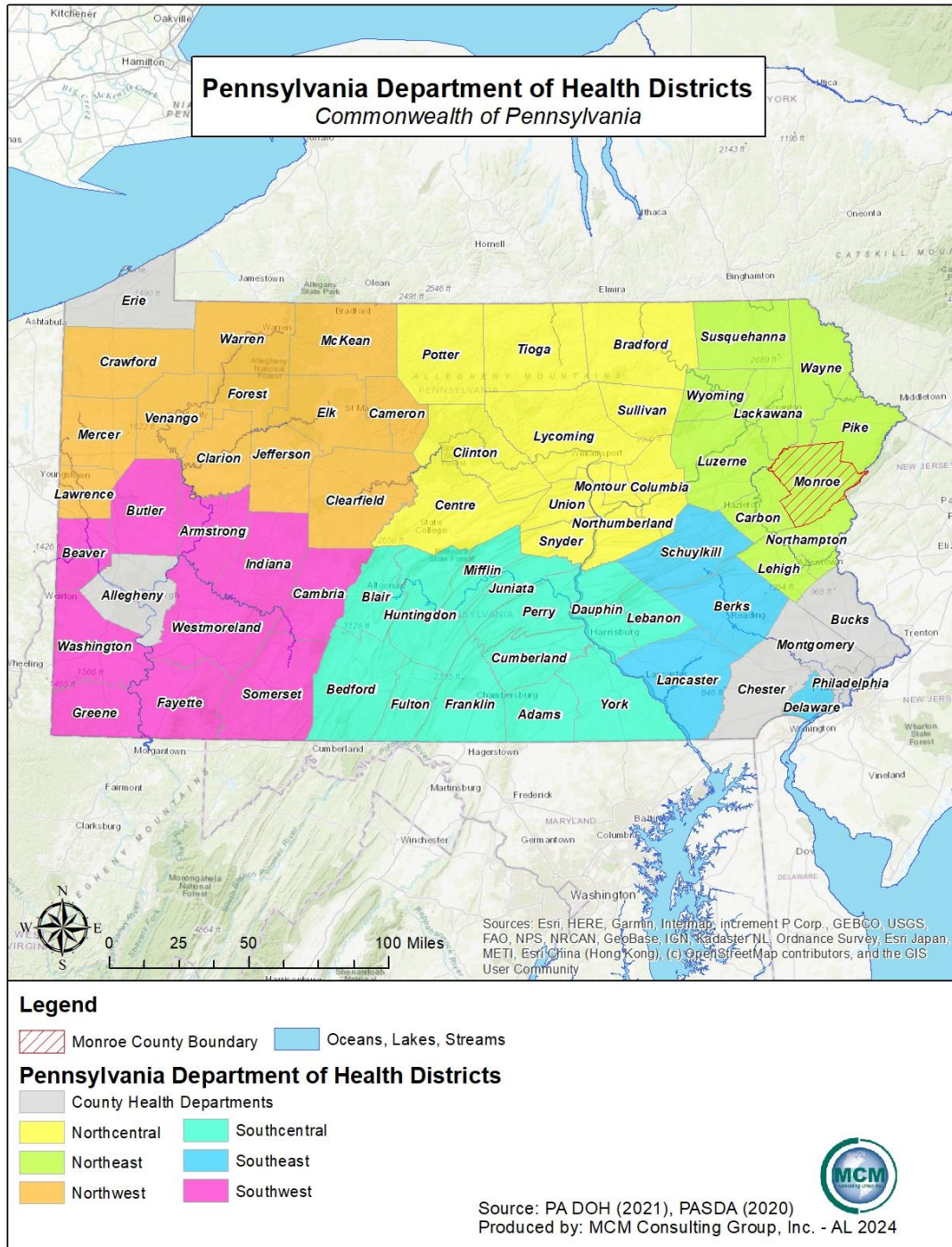
Land use and land development could directly impact the vulnerability of Monroe County to pandemic, epidemic, and infectious disease. Development of forested and rural areas could result in populations coming into direct contact with vectors for infectious disease including, most prominently, Lyme Disease and West Nile Virus. When rural and natural habitats for wildfire are developed, those vectors that live along and with wildlife have the potential to encounter individuals developing properties, and the populations that will occupy or live in those areas. An increase in development could also lead to an increase in the number of individuals living in Monroe County, increasing the county's vulnerability to pandemic events, like COVID-19.

Climate change can significantly impact the dynamics of pandemics, epidemics, and infectious diseases. Rising temperatures and altered precipitation patterns can expand the geographic range of disease vectors, such as mosquitoes carrying diseases like malaria and dengue fever. Changes in climate can also affect the behavior and distribution of animal hosts, potentially facilitating the transmission of zoonotic diseases to humans. Extreme weather events, intensified by climate change, can also disrupt healthcare systems and infrastructure, hindering the response to outbreaks. Additionally, shifts in temperature and humidity can influence the survival and spread of pathogens, potentially leading to the emergence of new infectious diseases. Overall, climate change exacerbates the complexity and challenges of managing and preventing pandemics and epidemics, making it crucial to address both environmental and public health concerns in a coordinated manner to mitigate the impact on global health.

Population changes can directly impact the vulnerability of Monroe County to pandemic events, like COVID-19. With increased populations there is a greater risk of the spread of communicable diseases, especially in areas where the population density is high. There are nine municipalities in Monroe County that have seen an increase in population between 2010 and 2020. This information is shown in *Table 3 – Population Change in Monroe County*. Monroe County should monitor population growth in the boroughs and townships of the county. The socially vulnerable populations in Monroe County are at a higher risk of pandemic, epidemic, and infectious diseases than more socially stable populations. This is due to lack of health care services for homeless, unsheltered, and transient populations in Monroe County and the difficulty in receiving treatment for health issues stemming from pandemics, epidemics, and infectious diseases. The national social vulnerability index for Monroe County from CDC/ATSDR (Center for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry) is 0.2664% which represents a low to medium level of vulnerability.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 23 - Pennsylvania Department of Health Districts



Source: (PA DOH, 2019)

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.7. Tornadoes/Windstorm

4.3.7.1 Location and Extent

Tornadoes and windstorms can occur throughout Monroe County and are usually localized in their location and extent. Severe thunderstorms may result in conditions favorable for the formation of windstorms, including tornadoes. Tornadoes are nature's most violent storms and can cause fatalities and devastation to neighborhoods and municipalities within the county and region. Tornadoes can occur at any time during the day or night but are most frequent during the later afternoon and early evening, which are typically the warmest hours of the day. Tornadoes are most likely to occur in the spring and summer.

Tornadoes

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, a tornado is formed. The other type of tornado is categorized as non-supercell, which is not as common as a supercell tornado. 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 and are typically weaker and more short-lived than supercell tornadoes. However, QLCS are more difficult to detect effectively. Another type of non-supercell tornado is a landspout. These tornadoes are narrow, rope-like funnels that form when a thundercloud grows without a rotating updraft, which causes the spinning motion common with tornadoes to appear near the ground.

Windstorms

Windstorms are experienced on a region-wide scale. The most frequent cause of windstorms in Pennsylvania are thunderstorms, although they may also be caused by hurricanes and winter storms. 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.

4.3.7.2 Range of Magnitude

Tornadoes

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 behind 1936. The number of tornado reports has increased since 1950. While the extent of tornado damage is

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 miles per hour (mph) or more and are capable of causing extreme destruction and turning normally harmless objects into deadly projectiles.

Tornado movement is characterized in two ways: direction/speed of spinning winds and the forward movement of the tornado, also known as the storm track. The rotational wind speeds can range from 65 to more than 200 mph. The speed of forward motion can range from 0 mph to 50 mph. Forward motion of a tornado path can be a few to several hundred miles in length. Widths of tornadoes vary from less than 100 feet in diameter to more than a mile wide in regard to the largest tornadoes on record. 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 distance,” which explains why one house in a tornado’s path may be completely demolished while a neighboring house could remain untouched. Some tornadoes never touch the ground and remain short lived, while others may touch the ground or “jump” along its path.

The destruction from tornadoes can range from minor to severe depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage 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. This scale can be seen in *Table 38 – Enhanced Fujita Scale*. The EF-Scale became effective on February 1, 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 38 – Enhanced Fujita Scale* shows F-Scale categories with corresponding EF-Scale wind speeds.

Figure 24 – Pennsylvania Wind Zones identifies wind speeds that could occur across the state, which may 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 the design of shelters and critical facilities should be able to withstand a three-second gust of up to 200 mph, regardless of whether the gust is a result of a tornado, hurricane, tropical storm, or windstorm incident. The western portion of the state falls within Zone IV, which indicates shelters can withstand up to 250 mph winds, while the eastern side falls within Zone II where shelters should be designed to withstand up to 160 mph.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Since Monroe County falls within Zone II, shelters and critical facilities should be designed to withstand up to 160mph winds, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm 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/windstorms of all types have caused the following problems in 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 38 - Enhanced Fujita Scale

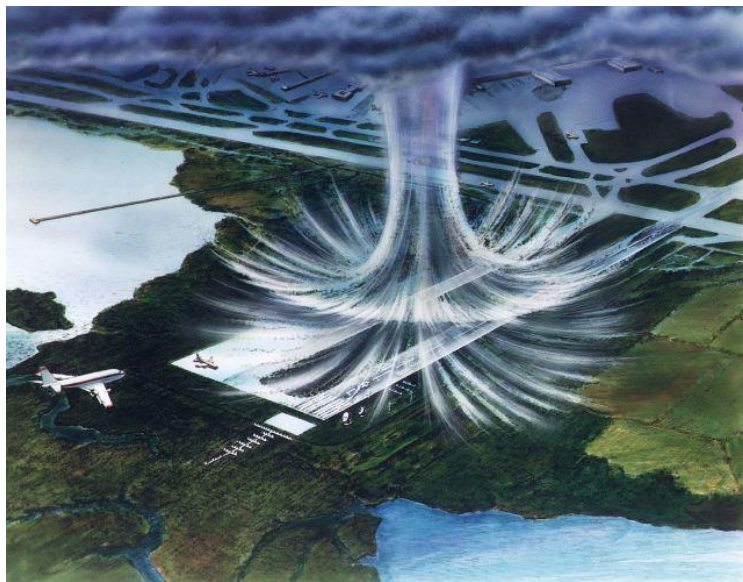
Enhanced Fujita Scale			
EF-Scale Number	Wind Speed (MPH)	F-Scale Number	Description of Potential Damage
EF0	65–85	F0-F1	Minor damage: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Enhanced Fujita Scale			
EF-Scale Number	Wind Speed (MPH)	F-Scale Number	Description of Potential Damage
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.
Source: NWS, 2007			

Most of the tornadoes that have struck Monroe County have occurred countywide. In 1985, a total of twenty-three confirmed tornadoes touched down across Eastern Ohio, Southwestern New York, and Central/Western Pennsylvania. This outbreak remains the worst in recorded history for this area. Of these twenty-three tornadoes, eight were of violent intensity (F4 or F5) with estimated wind speeds over 200 mph. Monroe County was impacted by the eastern most tornados that touched down during the 1985 outbreak.

Windstorms



Windstorms can be broken down into multiple categories. Straight-line winds are the most common wind event and are different from tornadic winds. It is a ground level, non-rotational, wind that comes out of a thunderstorm. Downdrafts are columns of air that rapidly sink toward the ground and are classified as either a macroburst or microburst. A macroburst is the outward burst of strong winds that are near or at the surface with horizontal dimensions greater than 2 ½ miles. Macrobusts

winds may begin over a smaller area and then spread out to a wider area, sometimes producing damage similar to a tornado. On the other hand, microbursts are smaller outward bursts of strong

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

winds near or at the surface. Microbursts are less than 2 ½ miles in horizontal dimension and are typically short-lived winds that last a maximum of ten minutes, with windspeeds reaching up to 100 mph. Microburst events can be wet or dry events. Wet microbursts are typically associated with heavy precipitation at the surface. Dry microbursts do not have precipitation associated with them and are commonly found in the western portion of the United States.

A gust front is 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.

4.3.7.3 Past Occurrence

Monroe County has experienced fourteen tornado events since 1954, and thirty-four wind incidents between 1996 and the writing of this plan, as seen in *Table 39 – Monroe County Tornado History* and *Table 40 – 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 between sources. Historically, the county has experienced both severe windstorms and tornadoes.

The most recent tornado impacted Chestnuthill Township on July 2, 2018. The path of this tornado started with tree damage along Jackson Road in Chestnuthill Township. Many trees were uprooted, and some were snapped. Additional tree damage was observed along Sportsman's Trail and Skyhawk Trail. The path of destruction continued through a corn field near the intersection of Mountain Road and Jackson Road. A large limb of approximately 18 inches in diameter was snapped off a tree and caused roof damage and downed power lines to a residence. Estimated maximum wind speed was 90 to 100 mph.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 39 - Monroe County Tornado History

Monroe County Tornado History					
Location	Date	Magnitude (F/EF Scale)	Deaths	Injuries	Property Damage
Monroe County	04/05/1952	F1	0	2	\$2,500.00*
Monroe County	09/13/1972	F2	0	0	\$2,500.00*
Monroe County	03/21/1976	F3	0	0	\$2,500,00.00*
Monroe County	10/05/1979	F0	0	0	\$2,500.00*
Monroe County	10/05/1979	F2	0	0	\$25,000.00*
Monroe County	10/05/1979	F1	0	0	\$2,500.00*
Monroe County	08/29/1983	F0	0	0	\$300.00*
Monroe County	05/31/1985	F1	0	0	\$2,500.00*
Monroe County	06/03/1985	F1	0	0	\$25,000.00*
Monroe County	11/08/1996	F1	0	0	\$400,000.00*
Monroe County	09/07/1998	F1	0	0	\$0.00*
Monroe County	07/01/2001	F0	0	0	\$0.00*
Monroe County	07/29/2009	EF2	0	2	\$1,000,000.00*
Monroe County	10/02/2018	EF1	0	0	\$0.00*
Source: NOAA NCEI, 2024 Estimated Values are marked*					

Table 40 - Monroe County High Wind History

Monroe County High Wind History				
Location	Date	Magnitude (knots)	Injuries	Property Damage
Monroe County	01/19/1996	Unknown	0	\$0.00*
Monroe County	03/19/1996	Unknown	0	\$0.00*
Monroe County	09/16/1999	50 kts.	0	\$400,000.00*
Monroe County	11/02/1999	50 kts.	0	\$0.00*
Monroe County	01/11/2000	Unknown	0	\$0.00*
Monroe County	01/11/2000	Unknown	0	\$0.00*
Monroe County	01/16/2000	Unknown	0	\$0.00*
Monroe County	04/08/2000	Unknown	0	\$0.00*
Monroe County	04/09/2000	Unknown	0	\$0.00*
Monroe County	12/12/2000	50 kts.	0	\$20,000.00*
Monroe County	12/17/2000	Unknown	0	\$0.00*
Monroe County	02/01/2001	Unknown	0	\$0.00*
Monroe County	01/13/2002	Unknown	0	\$0.00*
Monroe County	02/01/2002	Unknown	0	\$0.00*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County High Wind History				
Location	Date	Magnitude (knots)	Injuries	Property Damage
Monroe County	02/11/2002	Unknown	0	\$0.00*
Monroe County	03/10/2002	Unknown	0	\$0.00*
Monroe County	03/21/2002	Unknown	0	\$0.00*
Monroe County	09/11/2002	Unknown	0	\$0.00*
Monroe County	09/18/2003	50 kts.	0	\$1,000,000.00*
Monroe County	11/13/2003	50 kts.	0	\$50,000.00*
Monroe County	01/14/2006	53 kts.	0	\$100,000.00*
Monroe County	02/17/2006	50 kts.	0	\$100,000.00*
Monroe County	10/20/2006	53 kts.	0	\$5,000.00*
Monroe County	12/01/2006	50 kts.	0	\$10,000.00*
Monroe County	01/30/2008	50 kts.	0	\$10,000.00*
Monroe County	01/03/2010	51 kts.	0	\$10,000.00*
Monroe County	05/08/2010	50 kts.	0	\$0.00*
Monroe County	12/27/2010	54 kts.	0	\$5,000.00*
Monroe County	10/29/2012	57 kts.	0	\$930,000.00*
Monroe County	02/15/2015	57 kts.	0	\$25,000.00*
Monroe County	04/03/2016	50 kts.	0	\$0.00*
Monroe County	04/03/2016	52 kts.	0	\$0.00*
Monroe County	03/02/2018	52 kts.	0	\$0.00*
Monroe County	04/04/2018	52 kts.	0	\$0.00*
Monroe County	02/24/2019	51 kts.	0	\$0.00*
Monroe County	04/30/2021	50 kts.	0	\$0.00*
Source: NOAA NCEI, 2024 Estimated Values are marked*				

4.3.7.4 Future Occurrence

In the United States, tornado activity has increased in variability, with a general decrease in the number of days a year on which activity occurs, but an increase in the number of tornadoes on those days. This indicates an increase in tornado outbreaks. The future probability of a disastrous tornado occurring in Monroe County is ranked as possible, but not highly likely. While the chance of being hit by a tornado in Monroe County is small, the damage that results when the tornado arrives can be 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 in Pennsylvania. As jurisdictions within the county grow, and as residential and

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 country with hilly terrain, such as the majority of Pennsylvania. 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 uniquely high. The annual tornado season has begun to lengthen, with the season starting earlier than it has historically and ending later. Pennsylvania had, for example, a record number of tornadoes in April and May of 2019 compared to any other April and May on record. Climate change is causing temperatures and air moisture to increase, increasing the frequency and intensity of tornadoes and windstorms. There remains some uncertainty regarding the recurrence of tornadoes. Therefore, the number of future tornadoes and windstorm events could potentially increase due to known and unknown factors.

Based on historical incidents, there are three zones in Pennsylvania that can either experience less than one, one to four, or five to ten of EF-2 or above tornadoes per 3,700 square miles. Communities in Monroe County, as shown in *Figure 26 – Tornado Activity in Monroe County* below, are expected to have one to four tornadoes annually as a future occurrence. 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. Monroe County experiences windstorm events more commonly than tornadoes, which causes power failure, loss of communication networks, and residents requiring temporary shelters and provision of supplies. Therefore, unlike tornadoes, this hazardous event has a highly likely probability for future events to occur within the county.

Climate change and its relationship with tornado outbreaks is hard to identify. Some recent studies suggest that as average temperatures begin to rise, so will the intense storms that often lead to the creation of tornadoes. Warm, moist air is the most important aspect for developing strong tornadoes. Climate change can exacerbate this, and it could potentially lead to an increase in frequency and the severity of the events. Although not yet proven, this is one of the most prevalent theories on how climate change can impact tornado frequency and intensity.

4.3.7.5 Vulnerability Assessment

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 include the strength of the tornado, the time of day, and the area of

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 cascading impacts of tornadoes and windstorms including, but not limited to, 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 during such events.

Additional dangers that accompany tornado-associated thunderstorms, and which increase the vulnerability of Monroe County, include:

- Flash floods – 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 can cause several million in damages annually to property and crops

The economy of Monroe County is highly vulnerable to tornadoes. While there may be severe impact on financial and commercial systems of the economy, these storms, and the damage they cause, can disrupt business long-term. The local economy is vulnerable due to the possibility of being crippled by tornadoes and windstorms and their cascading effects when buildings and supporting infrastructure are destroyed in a storm. Power outages can create work stoppages, while transportation accidents and road closures can limit transportation of goods and services. Additionally, flooding cannot be discounted as it can destroy physical structures, merchandise, and equipment essential for business operation.

Monroe County's environment is also vulnerable to tornado events. However, since tornado events are typically localized, environmental impacts are rarely widespread. The impact of windstorms on the environment typically takes place over a large area. In either case, where these events occur, severe damage to plant species is likely. This includes uprooting or total destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Most notably, hazardous material spills can pollute ground water systems and vegetation. In the case of hazardous material spills, the local environment can be negatively impact and can cause extensive cleanup and mitigation efforts. Monroe County is considered a rural county that has a high amount of tourism that occurs in the surrounding hills, mountains, and state parks. Not only is the environment at risk to tornadoes and windstorms, but hikers, tourists, and hunters are also at risk when out in the environment. Consequently, in the event of a tornado or severe storm, these tourists have limited emergency notification measures which result in high vulnerability. A storm has the ability, potentially, to destroy structures, damage private and public property, and

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

injure citizens and tourists to the area. People with disabilities, the elderly, functional needs, and non-English speaking residents are more vulnerable to tornadoes, windstorms, and their cascading effects. Without assistance to evacuate and/or seek shelter, and with potential difficulty understanding information, these at-risk populations may be unable to prepare themselves, or their homes and other possessions, to safely endure the storm.

Tornado, windstorm, and cascading events may affect a small portion, or the entirety, of the county. Therefore, it is important to identify specific critical facilities and assets that are most vulnerable to this hazard. Critical facilities are highly vulnerable to windstorms and tornado events. While many severe storms can cause exterior damage to structures, tornadoes can destroy structures, along with their surrounding infrastructure, immediately halting their function. 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. Due to Pennsylvania Uniform Construction Code Act 45, trailers and mobile homes built before 2004, because of their lightweight construction and often unanchored design, are more vulnerable to high winds/tornadoes and will generally sustain more damage than will mobile homes built after 2004.

As seen in *Table 3 – Population Change in Monroe County*, East Stroudsburg Borough, Middle Smithfield Township, Price Township, Smithfield Township, Stroud Township, Tobyhanna Township, and Tunkhannock Township have seen a net population increase from the 2010 decennial census to the 2020 decennial census. Based on this information, it can be speculated that these municipalities may have an increased/equivalent vulnerability to tornado and windstorms, since 2010, due to the increase in population and construction.

Tornadoes and windstorm events may disproportionately affect underserved, unserved, and socially vulnerable populations, amplifying existing hardships. Fragile infrastructure in these areas is more prone to damage, which can hinder evacuation and rescue efforts. Limited access to resources exacerbates challenges during and after the storms, from securing safe shelter to obtaining essential supplies. Vulnerable communities often lack financial resilience, facing prolonged economic setbacks as local businesses may suffer.

Land use, in the form of a built environment, such as residential expansion, can cause tornado impact severity to increase. Impact severity increases when built environment expansion provides an influx of people, infrastructure, and critical infrastructure in harm's way. Since the

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

population in Monroe County had a minor overall increase between 2010 and 2020, it can be speculated that the built environment did not increase significantly.

There are no properties that are listed with the National Register of Historic Places that are at an increased risk of tornadoes in Monroe County. This analysis was run off of the previous tornado paths in the county and 500 feet vulnerability zones. These locations are where tornadoes have previously developed and may develop again.

Tornadoes and windstorms exert profound impacts on both natural and cultural areas. Ecologically, these intense weather events can result in habitat destruction, altering landscapes, and threatening biodiversity. Culturally, these storms endanger heritage sites, historic structures, and artifacts, eroding tangible, and intangible cultural elements. Sustainable recovery efforts must embrace an integrated approach, recognizing the interconnected vulnerability of natural, historical, and cultural landscapes to the formidable forces of tornadoes and windstorms.

All of the critical infrastructure and community lifeline facilities are vulnerable to tornado events. Some of the critical infrastructure can be considered at a higher risk due to the life safety missions that they serve. Facilities that are within 500 feet of previous tornado tracks can be considered at high risk of tornadoes.

Critical infrastructure and community lifelines at high risk (within 500 ft of previous tracks):

- None

Municipalities with an increased risk of tornadoes (previously impacted):

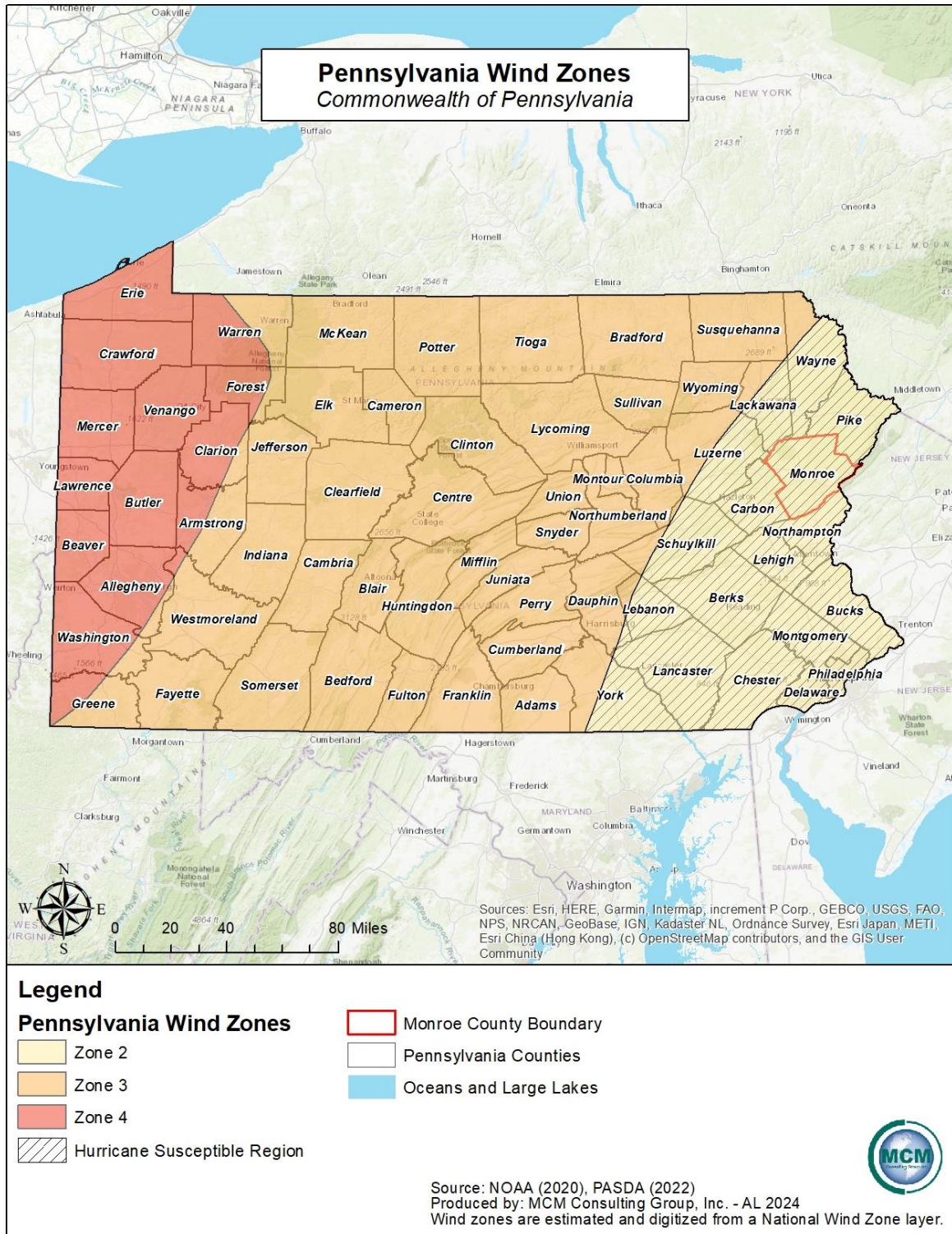
- | | |
|----------------------------|-----------------------|
| • Barrett Township | • Jackson Township |
| • Chestnuthill Township | • Paradise Township |
| • Coolbaugh Township | • Ross Township |
| • East Stroudsburg Borough | • Stroud Township |
| • Eldred Township | • Stroudsburg Borough |
| • Hamilton Township | |

Municipalities without an increased risk of tornadoes (not previously impacted):

- | | |
|------------------------------|------------------------|
| • Delaware Water Gap Borough | • Price Township |
| • Middle Smithfield Township | • Smithfield Township |
| • Mt Pocono Borough | • Tobyhanna Township |
| • Pocono Township | • Tunkhannock Township |
| • Polk Township | |

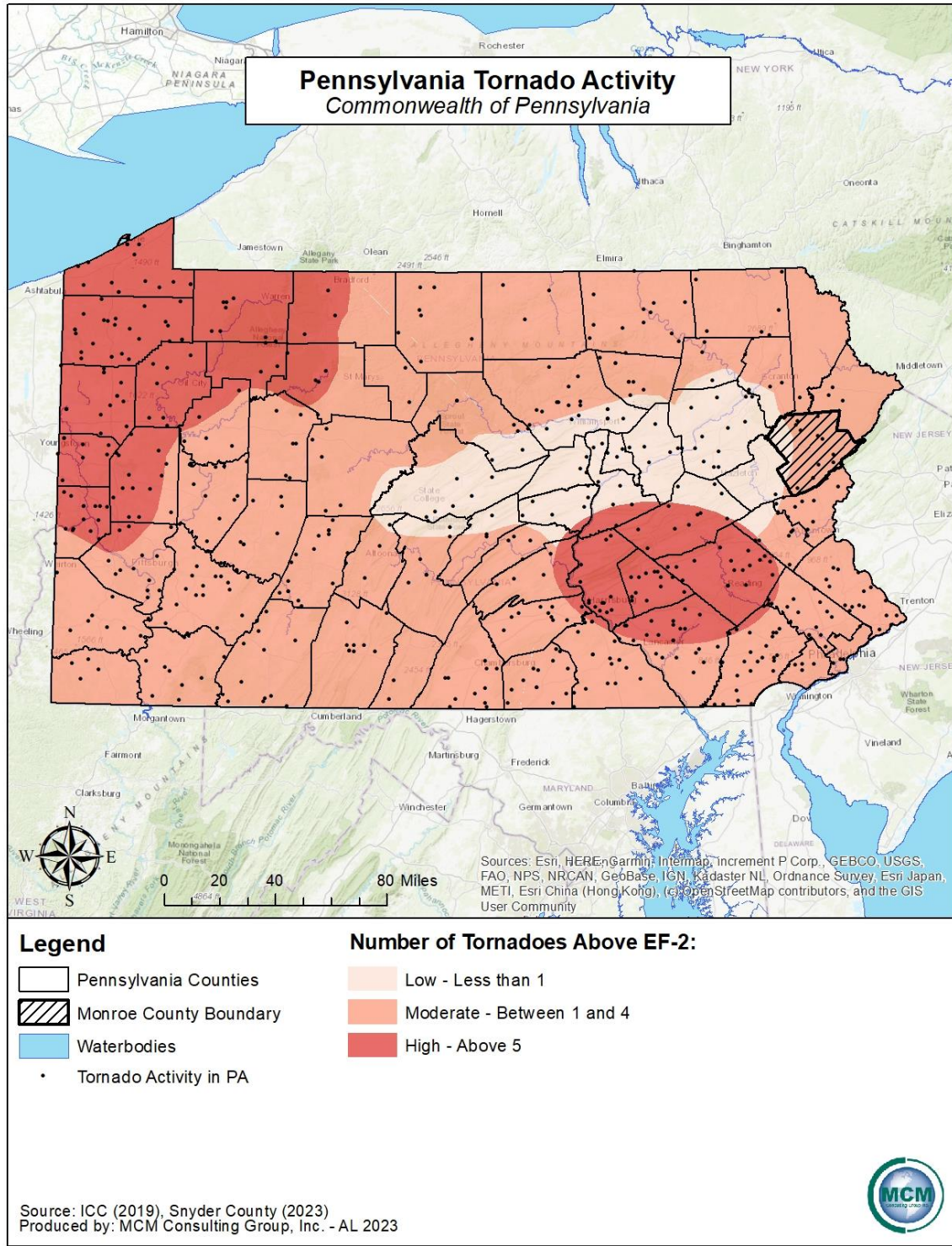
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Figure 24 - Pennsylvania Wind Zones



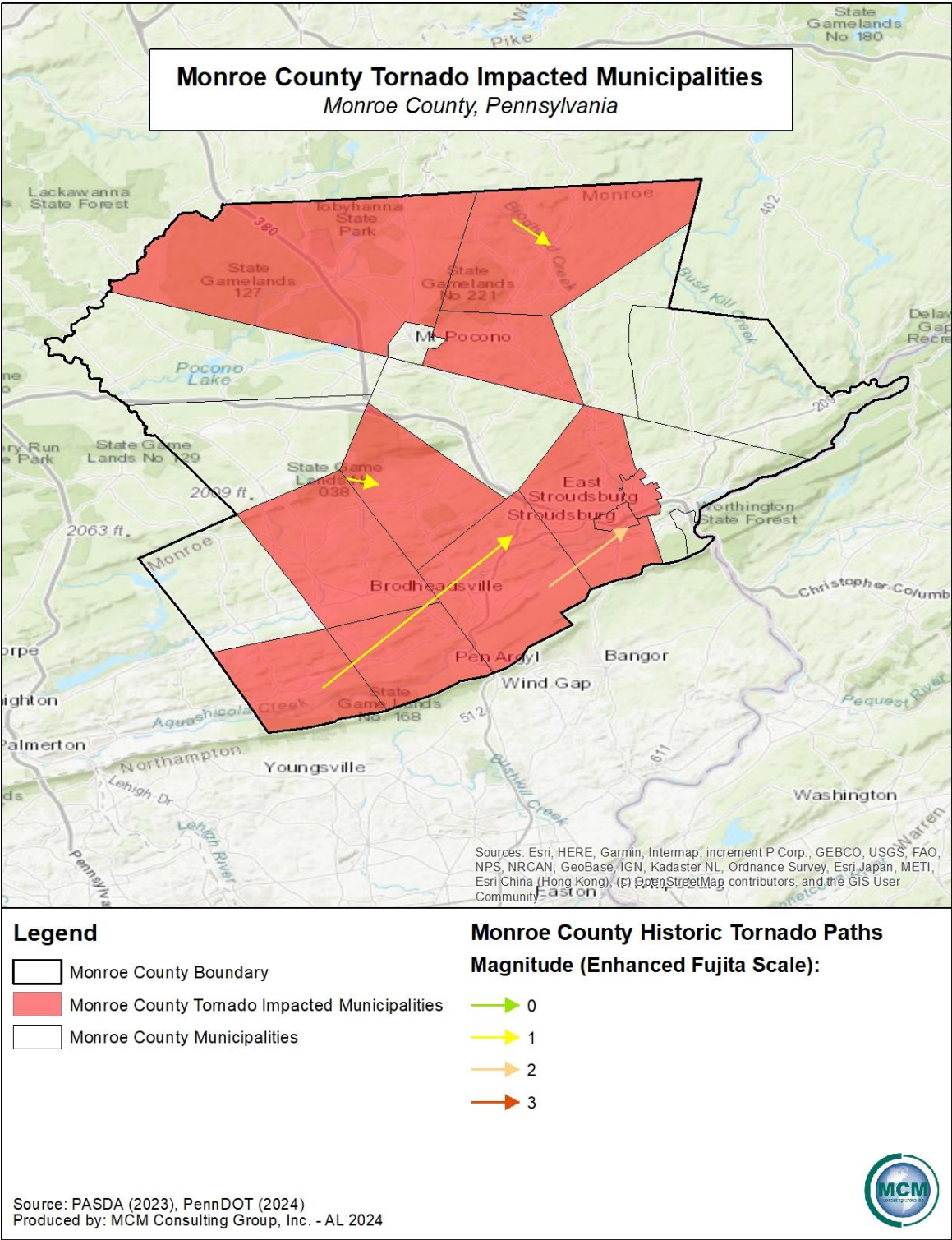
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 25 - Tornado Activity in Pennsylvania



Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Figure 26 - Tornado Activity in Monroe County



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.8. Wildfire

4.3.8.1 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.

4.3.8.2 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 including power outages may result. Other negative impacts of wildfires can include death of people, livestock, fish, and wildlife, and destruction of 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 detrimental effects if development in and/or around the natural areas increases.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

The United States Forest Service utilizes the Forest Fire Assessment System to classify the dangers of wildfire. *Table 41 – Wildland Fire Assessment System* identifies each threat classification and provides a description of the level.

Table 41 - 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.
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.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.8.3 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 a minimal amount 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 and Monroe counties. In 2023, there were a total of 164 fires in District 19 that were responsible for destroying 131.6 acres. In Monroe County, in 2016, over 8,000 acres were burned over a five-day period. This was considered a large wildfire event and remains the largest wildfire event recorded between the years 2000 and 2023. No major wildfires have occurred in Monroe County since the 2016 event.

District 19 reports the following twenty-three-year wildfire summary based on observed and reported wildfires. *Table 42 – Annual Summary of Wildfire Events in District 19* illustrates the number of acres burned in a certain number of fires for District 19 from the year 2000 to the year 2023.

Table 42 - Annual Summary of Wildfire Events in District 19

Annual Summary of Wildfire Events in District 19				
Year	Number of Fires	Frequency Increase or Decrease	Acres	Severity Increase or Decrease
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	↑

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Annual Summary of Wildfire Events in District 19				
Year	Number of Fires	Frequency Increase or Decrease	Acres	Severity Increase or Decrease
2015	41	↑	186.8	↓
2016	37	↓	8690.0	↑
2017	12	↓	143.1	↓
2018	31	↑	29.6	↓
2019	22	↓	12.5	↓
2020	61	↑	853.7	↑
2021	74	↑	38.7	↓
2022	90	↑	383.7	↑
2023	164	↑	131.6	↓
Source: DCNR, 2024				

In recent years, the number of prescribed burns in Pennsylvania has been increasing. This corresponds to an understanding of the need for fire in many natural ecosystems and management strategies for reducing vulnerability to wildfire; it also improves hunting opportunities. In 2022, there were sixty-three prescribed burns that were carried out by the Pennsylvania Department of Conservation and Natural Resources (DCNR). This number was an increase of seventeen prescribed burns from the total number of reported prescribed burns in 2021 by the DCNR, with a previous total of forty-six. At the time of writing this plan, data on 2023 prescribed burns by DCNR were unavailable.

Monroe County utilizes a database system called WebEOC to track incidents that have occurred within the county. Data from 2021 to 2024 has been recorded for different incident types within the county. *Table 43 – Wildfire Events in Monroe County* illustrates the different fire type incidents that have occurred between 2021 and 2024.

Table 43 - Wildfire Events in Monroe County

Wildfire Events in Monroe County			
Location	Start Date	End Date	Fire Type
Monroe County	n/a	04/03/2021	Brush Fire
Smithfield Township	n/a	04/02/2021	Brush Fire
Hamilton Township	n/a	04/02/2021	Brush Fire
Monroe County	n/a	04/20/2021	Brush Fire
Monroe County	n/a	04/20/2021	Brush Fire
Hamilton Township	n/a	05/01/2021	Brush Fire
Polk Township	n/a	05/02/2021	Brush Fire
Monroe County	n/a	03/10/2021	2020 Monroe County Brush Fires

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Wildfire Events in Monroe County			
Location	Start Date	End Date	Fire Type
Hamilton Township	n/a	04/29/2022	Brush Fire
Monroe County	03/10/2021	06/04/2021	2021 Monroe County Brush Fires
Hamilton Township	03/10/2021	03/10/2021	
Paradise Township	03/12/2021	03/12/2021	Brush Fire
Ross Township	03/21/2021	03/21/2021	Brush Fire
Chestnuthill Township	03/21/2021	03/21/2021	Brush Fire
Hamilton Township	03/22/2021	03/22/2021	Brush Fire
Hamilton Township	03/22/2021	03/22/2021	Brush Fire
Tunkhannock Township	03/23/2021	03/23/2021	Brush Fire
Smithfield Township	03/26/2021	03/26/2021	Brush Fire
Hamilton Township	03/30/2021	03/30/2021	Brush Fire
Coolbaugh Township	03/30/2021	03/30/2021	Bursh Fire
Jackson Township	04/03/2021	04/03/2021	Brush Fire
Chestnuthill Township	04/04/2021	04/04/2021	Brush Fire
Pocono Township	04/05/2021	04/05/2021	Brush Fire
Stroud Township	04/05/2021	04/05/2021	Brush Fire
Hamilton Township	04/05/2021	04/05/2021	Brush Fire
Stroudsburg Borough	04/05/2021	04/05/2021	Brush Fire
Mt. Pocono Borough	04/06/2021	04/06/2021	Brush Fire
Pocono Township	04/06/2021	04/06/2021	Brush Fire
Hamilton Township	04/06/2021	04/06/2021	Brush Fire
Coolbaugh Township	04/06/2021	04/06/2021	Brush Fire
Middle Smithfield Township	04/08/2021	04/08/2021	Brush Fire
Jackson Township	04/08/2021	04/08/2021	Brush Fire
Paradise Township	04/18/2021	04/18/2021	Brush Fire
Monroe County	04/20/2021	04/20/2021	Brush Fire
Polk Township	04/23/2021	04/23/2021	Brush Fire
Jackson Township	04/24/2021	04/27/2021	Brush Fire
Tobyhanna Township	04/24/2021	04/24/2021	Brush Fire
Middle Smithfield Township	04/24/2021	04/24/2021	Brush Fire
Eldred Township	04/26/2021	04/26/2021	Brush Fire
Smithfield Township	04/26/2021	04/26/2021	Brush Fire
Hamilton Township	04/26/2021	04/26/2021	Brush Fire
Barrett Township	04/27/2021	04/27/2021	Brush Fire
Ross Township	04/28/2021	04/28/2021	Brush Fire
Pocono Township	04/28/2021	04/28/2021	Brush Fire
Hamilton Township	04/28/2021	04/28/2021	Brush Fire
Polk Township	04/28/2021	04/28/2021	Brush Fire
Pocono Township	04/28/2021	04/28/2021	Brush Fire

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Wildfire Events in Monroe County			
Location	Start Date	End Date	Fire Type
Pocono Township	04/28/2021	04/28/2021	Brush Fire
Jackson Township	05/02/2021	05/02/2021	Brush Fire
Middle Smithfield Township	12/16/2021	12/16/2021	Brush Fire
Monroe County	03/16/2022	08/05/2022	2022 Monroe County Brush Fires
Stroud Township	03/16/2022	03/16/2022	Brush Fire
Eldred Township	03/16/2022	03/16/2022	Brush Fire
Middle Smithfield Township	03/21/2022	03/21/2022	Brush Fire
Polk Township	03/21/2022	03/21/2022	Brush Fire
Pocono Township	03/21/2022	03/21/2022	Brush Fire
Jackson Township	03/22/2022	03/22/2022	Brush Fire
Pocono Township	03/22/2022	03/22/2022	Brush Fire
Chestnuthill Township	03/22/2022	03/22/2022	Brush Fire
Hamilton Township	03/29/2022	03/29/2022	Brush Fire
Pocono Township	04/02/2022	04/02/2022	Brush Fire
Chestnuthill Township	04/13/2022	04/13/2022	Brush Fire/Unresponsive Person
Jackson Township	04/15/2022	04/15/2022	Brush Fire
Middle Smithfield Township	04/15/2022	04/15/2022	Brush Fire
Chestnuthill Township	04/15/2022	04/15/2022	Brush Fire
Smithfield Township	04/15/2022	04/15/2022	Brush Fire
Pocono Township	04/15/2022	04/15/2022	Brush Fire
Stroud Township	04/15/2022	04/15/2022	Brush Fire
Tobyhanna Township	04/15/2022	04/15/2022	Brush Fire
Paradise Township	04/16/2022	04/16/2022	Brush Fire
Smithfield Township	04/16/2022	04/16/2022	Brush Fire
Price Township	04/17/2022	04/17/2022	Brush Fire
Barrett Township	04/23/2022	04/23/2022	Wildfire – Air Tanker Support
Tunkhannock Township	04/24/2022	04/25/2022	Brush Fire
Tunkhannock Township	04/24/2022	04/26/2022	Wildfire – Air Tanker Support
Barrett Township	04/24/2022	04/24/2022	Brush Fire
Chestnuthill Township	04/24/2022	04/24/2022	Brush Fire
Jackson Township	04/24/2022	04/24/2022	Brush Fire
Hamilton Township	04/28/2022	04/28/2022	Brush Fire
Pocono Township	04/28/2022	04/28/2022	Brush Fire
Paradise Township	04/29/2022	04/29/2022	Brush Fire
Middle Smithfield Township	04/29/2022	04/29/2022	Brush Fire
Chestnuthill Township	04/29/2022	04/29/2022	Brush Fire
Mt. Pocono Borough	04/29/2022	04/29/2022	Brush Fire
Eldred Township	04/30/2022	04/30/2022	Brush Fire
Coolbaugh Township	04/30/2022	04/30/2022	Brush Fire

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Wildfire Events in Monroe County			
Location	Start Date	End Date	Fire Type
Pocono Township	04/30/2022	04/30/2022	Brush Fire
Tunkhannock Township	04/30/2022	04/30/2022	Brush Fire
Chestnuthill Township	04/30/2022	04/30/2022	Brush Fire
Middle Smithfield Township	04/30/2022	04/30/2022	Brush Fire
Coolbaugh Township	04/30/2022	04/30/2022	Brush Fire
Paradise Township	05/01/2022	05/01/2022	Brush Fire
Paradise Township	05/01/2022	05/01/2022	Brush Fire
Price Township	05/01/2022	05/01/2022	Brush Fire
Coolbaugh Township	05/01/2022	05/01/2022	Brush Fire
Coolbaugh Township	05/01/2022	05/01/2022	Brush Fire
Paradise Township	05/01/2022	05/01/2022	Brush Fire
Middle Smithfield Township	05/01/2022	05/01/2022	Brush Fire
Barrett Township	08/15/2022	08/15/2022	Brush Fire
Pocono Township	08/19/2022	08/19/2022	Brush Fire
Pocono Township	08/19/2022	08/19/2022	Brush Fire
Coolbaugh Township	11/04/2022	11/04/2022	Brush Fire
Coolbaugh Township	11/04/2022	11/04/2022	Brush Fire
Hamilton Township	11/10/2022	11/10/2022	Brush Fire
Paradise Township	02/05/2023	02/06/2023	Brush Fire
Pocono Township	02/10/2023	02/10/2023	Brush Fire
Eldred Township	02/15/2023	02/15/2023	Brush Fire
Smithfield Township	02/19/2023	02/19/2023	Brush Fire
Barrett Township	02/19/2023	02/19/2023	Brush Fire
Price Township	02/26/2023	02/26/2023	Brush Fire
Ross Township	02/26/2023	02/26/2023	Brush Fire
Price Township	03/09/2023	03/09/2023	Brush Fire
Smithfield Township	03/20/2023	03/20/2023	Brush Fire
Pocono Township	03/21/2023	03/21/2023	Brush Fire
Jackson Township	03/21/2023	03/21/2023	Brush Fire
Hamilton Township	03/21/2023	03/21/2023	Brush Fire
Smithfield Township	03/21/2023	03/21/2023	Brush Fire
Tunkhannock Township	03/22/2023	03/22/2023	Brush Fire
Eldred Township	04/07/2023	04/07/2023	Brush Fire
Smithfield Township	04/14/2023	04/14/2023	Brush Fire
Tunkhannock Township	04/14/2023	04/14/2023	Brush Fire
Tobyhanna Township	04/14/2023	04/14/2023	Brush Fire
Ross Township	04/14/2023	04/14/2023	Brush Fire
Tobyhanna Township	04/21/2023	04/21/2023	Brush Fire
Tunkhannock Township	04/22/2023	04/22/2023	Brush Fire

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Wildfire Events in Monroe County			
Location	Start Date	End Date	Fire Type
Hamilton Township	06/05/2023	06/07/2023	Brush Fire
Smithfield Township	03/16/2024	03/16/2024	Brush Fire
East Stroudsburg Borough	03/16/2024	03/16/2024	Brush Fire
Source: WebEOC™ Closed Incident Data, 2024			

4.3.8.4 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). In some regions of the United States, this is a very real concern. Northern California has experienced unprecedented devastating wildfires in 2017, 2018, 2019, 2020, 2021, 2022, and 2023. 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 relevant to wildfires. 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).

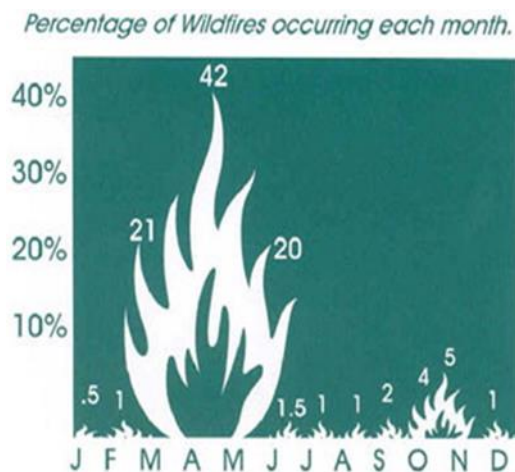
Climate change significantly influences wildfires by altering environmental conditions. Rising temperatures, prolonged droughts, and changes in precipitation patterns create drier landscapes, fostering the ignition and rapid spread of wildfires. Elevated temperatures contribute to increased evaporation, drying out vegetation and creating more fuel for fires. Altered precipitation patterns can lead to extended periods of drought, further desiccating ecosystems. Climate change also affects the timing and intensity of seasons, extending the fire-prone period. Additionally, warming temperatures facilitate the expansion of pests and diseases that weaken trees, making forests more susceptible to ignition.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.8.5 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 27 – Seasonal Wildfire Percentage* shows the wildfire percentage occurrence during each month in Pennsylvania.

Figure 27 - Seasonal Wildfire Percentage



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 people 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 28 – 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.

There are twenty-nine fire departments that serve Monroe County. 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. There is a potential for fire stations and services to close, which affects response to a wildfire in Monroe County. *Figure 29 – Fire Stations Locations* illustrates the position of fire stations and the location of state game lands, state forests, and natural areas within Monroe County. It is recommended that each municipality assess vulnerabilities to department closures by building a relationship with their local providers and planning accordingly for if a local service were to close.

As seen above in Section 4.3.8.4 climate change may increase the frequency of wildfires. With this potential increase in wildfires comes disruption of systems that humans rely upon for daily activities. The systems wildfires most heavily impact transportation, water supply, power, and communications. Wildfires can block off transportation routes directly or can impact visibility of transportation routes due to the intense smoke that can be produced and settle over roadways.

As seen in *Table 3 – Population Change in Monroe County*, East Stroudsburg Borough, Middle Smithfield Township, Price Township, Smithfield Township, Stroud Township, Tobyhanna Township, and Tunkhannock Township have seen a net population increase from the 2010 decennial census to the 2020 decennial census. Based on this information, it can be speculated that these municipalities may have an increased vulnerability to wildfires, since 2010, due to the increase in population. Unserved, underserved, and socially vulnerable populations within Monroe County may be at an increased vulnerability to wildfires. This is because these populations may not have access to or the ability to relocate during wildfire events. Those that are unsheltered within Monroe County have an increased vulnerability to wildfire events due to being openly exposed to the elements, such as bad air quality from the smoke that wildfires produce.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Monroe County promotes fishing, hunting, camping, hiking, canoeing, and other outdoor activities. These land use events can increase the risk of wildfires starting. Approximately 79% of land use in Monroe County is forest areas that can be credited for streams and drinking water resources according to the *Plan for Clean Water Monroe County, PA*. Natural areas can be extremely vulnerable to wildfires within Monroe County. Ecologically, these alter landscapes, compromising soil stability and disrupting ecosystems. Conditions of drought or invasive species that could damage forested areas can lead to wildfires. Wildfires can lead to devastation which can foster landslides and flash flood events. These events can destroy the forested terrain within the county and consume acres of traditional agricultural practices in a short amount of time. In addition to widespread burning that wildfires cause, these events also pollute the air within the county and surrounding areas, as well as waterways due to run off and the settling of the air pollution to ground level.

Most of the historic and cultural properties that are located in Monroe County are at an increased vulnerability to wildfire events. Each property is of a construction type that would be vulnerable to wildfires in Monroe County. The majority of the historic properties in the county are constructed out of brick and stone, with wooden interiors that would be destroyed by fires. Also, only ten historic places are within two miles of a fire station in Monroe County. These locations are the Cold Spring Farm Springhouse, Delaware, Lackawanna, and Western Railroad Water Gap Station, East Stroudsburg Armory, East Stroudsburg Railroad Station, Kitson Woolen Mill, Monroe County Courthouse, Schoonover Mountain House, Captain John Shoemaker House, Stroud Mansion, and John Turn Farm. All other historic properties in the county are farther away from fire station locations which could result in a longer response time to fires.

Municipalities with high risk due to wildfires (with areas of high-density interface or intermix):

- Barrett Township
- Chestnuthill Township
- Coolbaugh Township
- Delaware Water Gap Borough
- East Stroudsburg Borough
- Eldred Township
- Hamilton Township
- Jackson Township
- Middle Smithfield Township
- Mount Pocono Borough
- Paradise Township
- Pocono Township
- Polk Township
- Price Township
- Ross Township
- Smithfield Township
- Stroud Township
- Stroudsburg Borough
- Tobyhanna Township
- Tunkhannock Township

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

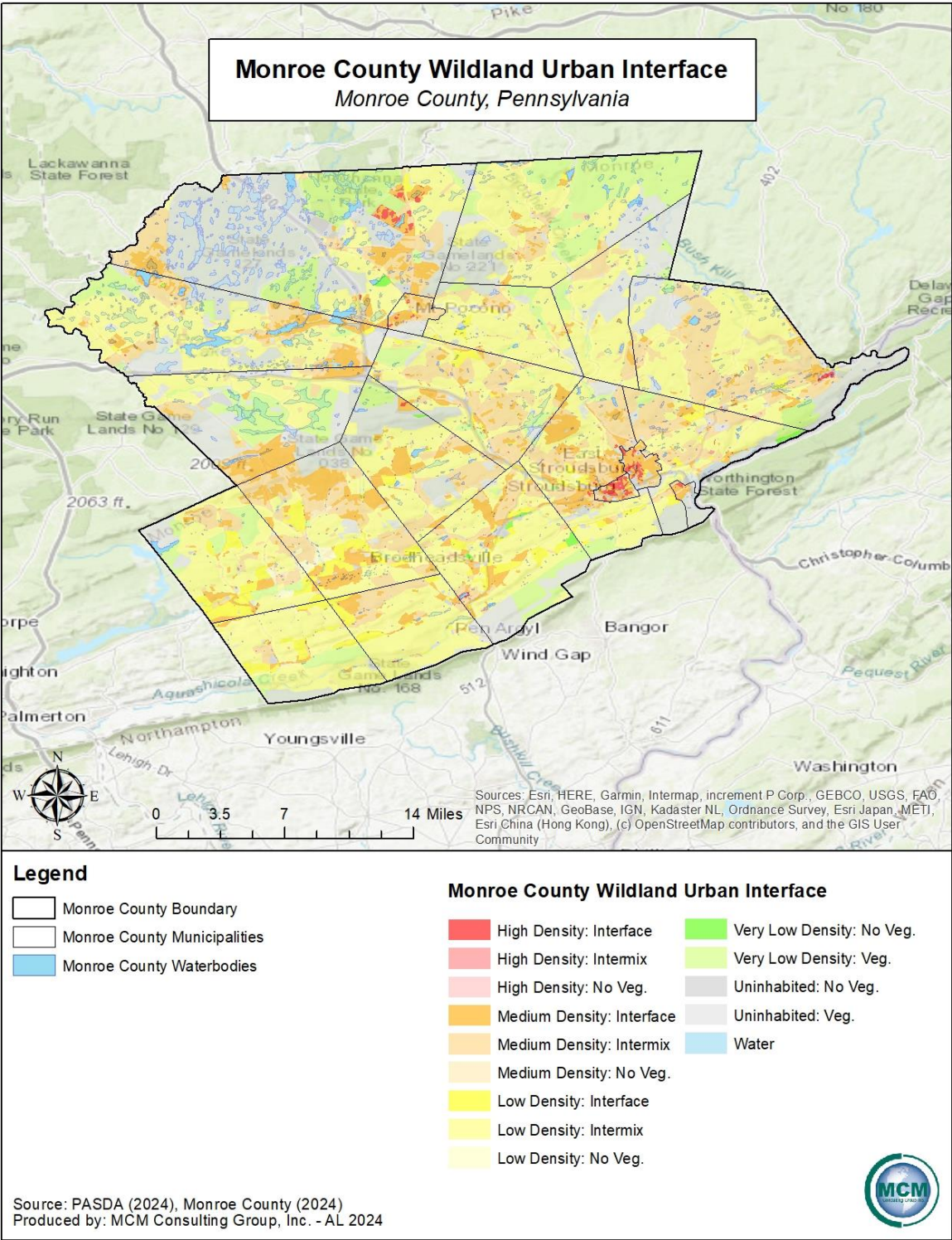
Municipalities with lower risk due to wildfires (no areas of high-density interface or intermix):

- No municipalities

As part of the larger public outreach effort of this hazard mitigation plan, there was an identified wildfire vulnerable area outlined by a member of the public for Chestnuthill Township. This area, based on the public knowledge, is located west of Sugar Hollow Road.

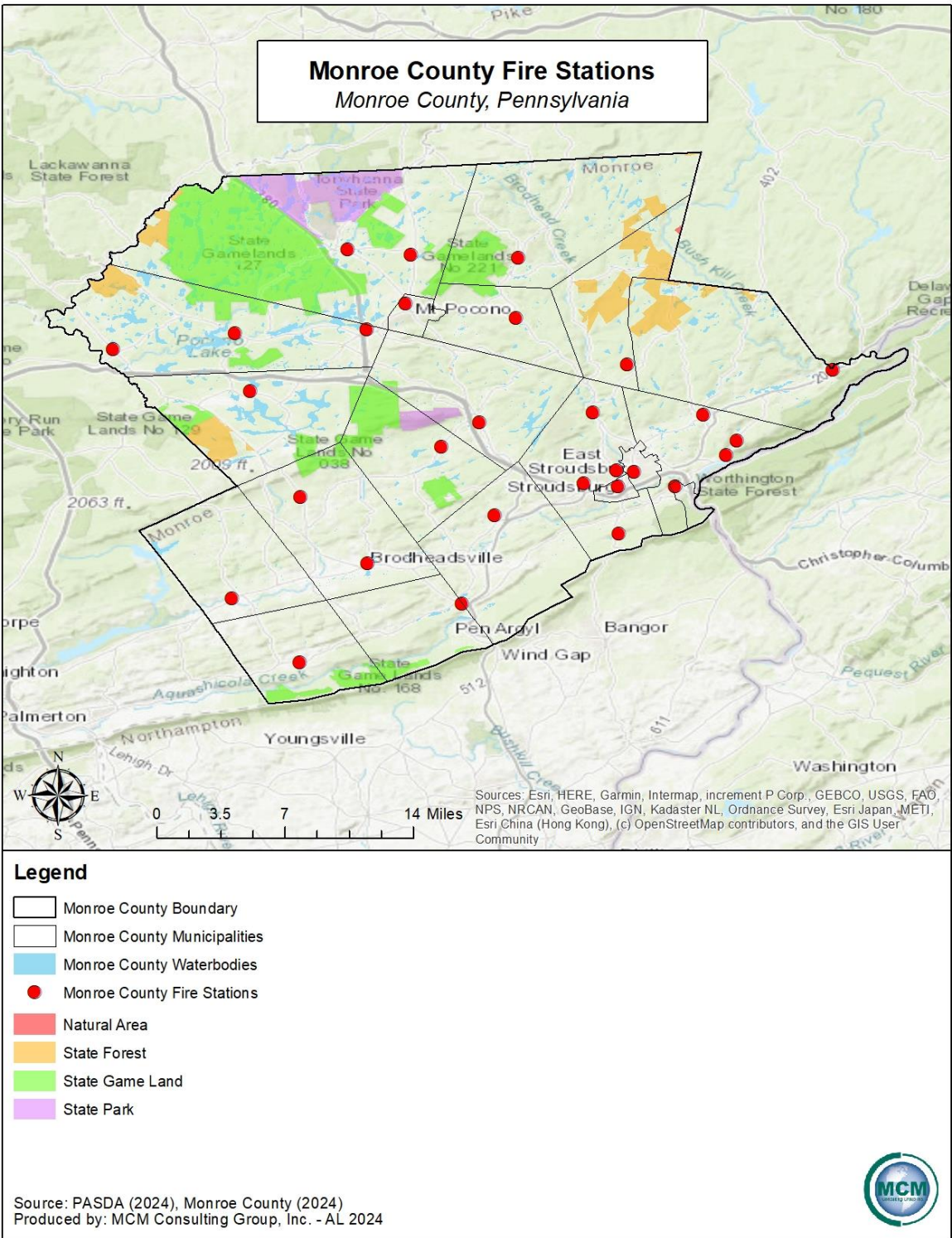
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 28 - Wildland Urban Interface



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 29 - Fire Station Locations



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.9. Winter Storm

4.3.9.1 Location and Extent

Most severe winter storm hazards include heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. Since most extra-tropical cyclones (mid-Atlantic cyclones locally known as Northeasters or Nor'easters), generally take place during the winter weather months, these hazards have also been grouped as a type of severe winter weather storm. According to the Pennsylvania State Hazard Mitigation Plan (PA HMP), winter storms are frequent events for the Commonwealth and occur from late October until mid-April. These types of winter events or conditions are further defined below.

- **Heavy Snow:** According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to four inches or more in depth in twelve hours or less; or snowfall accumulating to six inches or more in depth in twenty-four hours or less. A snow squall is an intense but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning.
- **Blizzard:** Blizzards are characterized by low temperatures, wind gusts of thirty-five miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to 1/4-mile or less for an extended period (three or more hours).
- **Sleet or Freezing Rainstorm:** Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground and other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground.
- **Ice Storm:** An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous and can create extreme hazards to motorists and pedestrians.

Extra-Tropical Cyclone: Sometimes called mid-latitude cyclones, are a group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes of the Earth. These storms have neither tropical nor polar characteristics and relate to fronts and horizontal gradients in temperature and dew point otherwise known as “baroclinic zones”. Extra-tropical cyclones are everyday weather phenomena which, along with anticyclones, drive the weather over much of the Earth. These cyclones produce impacts ranging from cloudiness and mild showers to heavy gales and thunderstorms. Tropical cyclones often transform into extra-tropical cyclones at the end of their tropical existence, usually between 30° and 40° latitude,

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

where there is insufficient force from upper-level shortwave troughs riding the westerlies (weather systems moving west to east) for the process of extra-tropical transition to begin. A shortwave trough is a disturbance in the mid or upper part of the atmosphere which induces upward motion ahead of it. During an extra-tropical transition, a cyclone begins to tilt back into the colder air mass with height, and the cyclone's primary energy source converts from the release of latent heat from condensation to baroclinic processes.

4.3.9.2 Range of Magnitude

The magnitude or severity of a severe winter storm depends on several factors including a region's susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season. The extent of a severe winter storm can be classified by meteorological measurements, such as those above, and by evaluating its societal impacts.

The Northeast Snowfall Impact Scale (NESIS) categorizes snowstorms in this manner. Unlike the Fujita Scale (tornado) and Saffir Simpson Scale (hurricanes), there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service and rank high impact, northeast snowstorms. These storms have large areas of ten-inch snowfall accumulations and greater. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5). These ranking can be seen in *Table 44 – NESIS Winter Storm Rankings*. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact of northeast snowstorms can have on the rest of the country in terms of transportation and economic impact.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Table 44 - NESIS Winter Storm Rankings

NESIS Winter Storm Rankings			
Category	Description	NESIS Range	Definition
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4-inch accumulations and small areas of 10-inch snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10-inch snow while some include small areas of 20-inch snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations (greater than 30 inches).
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10-inch snows (generally between 50 and 150 x 103 mi ² – roughly one to three times the size of New York State with significant areas of 20-inch accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10-inch snowfalls, and each case is marked by large areas of 20-inch and greater snowfall.
5	Extreme	10+	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 inches. These are only storms in which the 10-inch accumulations exceed 200 X 103 mi ² and affect more than 60 million people.
Source: Kocin and Uccellini, 2004			

The climate of Pennsylvania is marked by abundant snowfall. Winter weather can reach Pennsylvania as early as October and is usually in full force by late November with average winter temperatures between 20- and 40-degrees Fahrenheit. Monroe County receives an average of about 41.6 inches of snowfall a year. Most areas of Monroe County experience the effects of winter storms frequently. The general indication of the average annual snowfall map shows areas that are subject to a consistent risk for large quantities of snow. *Figure 31 - Pennsylvania Annual*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Snowfall 1981 – 2010 illustrates the long-term trends for snowfall accumulation in Pennsylvania over three decades.

4.3.9.3 Past Occurrence

Figure 30 – Winter Storm Events by County in Pennsylvania shows the number of winter storm events from 1950 – 2013 for the Commonwealth of Pennsylvania. Monroe County had eighty-one winter storm events, 301 winter weather events, eleven ice storms, and two blizzards between 1950 and the writing of this plan. *Table 45 – Recent Annual Snowfall Estimates* shows recent annual snowfall measurements as stated by NOAA. Overall, Monroe County has experienced a decrease in the annual estimated average of snowfall. On average, the annual snowfall totals have decreased in the time periods from 2020 to current. A list of additional Monroe County winter storms, and other related events is outlined in *Table 46 – Monroe County Winter Weather History*.

Table 45 - Recent Annual Snowfall Estimates

Recent Annual Snowfall Estimates	
Time Span	Snowfall Estimates (inches)
1999-2000	32.8
2000-2001	59.4
2001-2002	16.1
2002-2003	84.7
2003-2004	53.6
2004-2005	62.5
2005-2006	33.6
2006-2007	33.3
2007-2008	47.9
2008-2009	40.2
2009-2010	53.1
2010-2011	3.9
2011-2012	M
2012-2013	5.4
2013-2014	M
2014-2015	54.2
2015-2016	25.2
2016-2017	42
2017-2018	65.4
2018-2019	38.3
2019-2020	11.4
2020-2021	57.2
2021-2022	25.2
2022-2023	23.3
Source: NOAA, 2024	

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 46 - Monroe County Winter Weather History

Monroe County Winter Weather History		
Location	Date	Event Type
Monroe County	01/02/1996	Winter Storm
Monroe County	01/07/1996	Blizzard
Monroe County	03/07/1996	Winter Storm
Monroe County	03/28/1996	Ice Storm
Monroe County	01/16/1997	Winter Storm
Monroe County	02/14/1997	Winter Storm
Monroe County	11/13/1997	Winter Storm
Monroe County	12/22/1997	Winter Storm
Monroe County	12/29/1997	Winter Storm
Monroe County	01/15/1998	Ice Storm
Monroe County	01/23/1998	Winter Storm
Monroe County	02/23/1998	Winter Storm
Monroe County	03/21/1998	Winter Storm
Monroe County	01/02/1999	Winter Storm
Monroe County	01/08/1999	Winter Storm
Monroe County	01/13/1999	Winter Storm
Monroe County	02/13/2000	Ice Storm
Monroe County	02/18/2000	Winter Storm
Monroe County	12/13/2000	Winter Storm
Monroe County	01/20/2001	Winter Storm
Monroe County	02/16/2001	Ice Storm
Monroe County	02/25/2001	Winter Storm
Monroe County	03/04/2001	Winter Storm
Monroe County	03/12/2001	Ice Storm
Monroe County	03/29/2001	Ice Storm
Monroe County	03/26/2002	Ice Storm
Monroe County	11/16/2002	Winter Storm
Monroe County	12/11/2002	Winter Storm
Monroe County	12/24/2002	Winter Storm
Monroe County	01/02/2003	Winter Storm
Monroe County	12/05/2003	Winter Storm
Monroe County	12/14/2003	Winter Storm
Monroe County	01/04/2004	Ice Storm
Monroe County	01/27/2004	Winter Storm
Monroe County	02/03/2004	Winter Storm
Monroe County	02/06/2004	Winter Storm
Monroe County	03/16/2004	Winter Storm
Monroe County	01/05/2005	Winter Storm

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Winter Weather History		
Location	Date	Event Type
Monroe County	01/08/2005	Ice Storm
Monroe County	02/20/2005	Winter Storm
Monroe County	03/23/2005	Winter Storm
Monroe County	12/16/2005	Winter Storm
Monroe County	01/03/2006	Winter Storm
Monroe County	01/23/2006	Winter Storm
Monroe County	02/12/2006	Winter Storm
Monroe County	03/02/2006	Winter Storm
Monroe County	02/13/2007	Winter Storm
Monroe County	12/02/2007	Winter Storm
Monroe County	12/15/2007	Winter Storm
Monroe County	02/01/2008	Winter Storm
Monroe County	02/12/2008	Winter Storm
Monroe County	02/21/2008	Winter Storm
Monroe County	12/10/2008	Winter Storm
Monroe County	12/19/2008	Winter Storm
Monroe County	01/06/2009	Winter Storm
Monroe County	01/10/2009	Winter Storm
Monroe County	01/27/2009	Winter Storm
Monroe County	12/08/2009	Winter Storm
Monroe County	01/17/2010	Ice Storm
Monroe County	02/09/2010	Winter Storm
Monroe County	02/22/2010	Winter Storm
Monroe County	02/25/2010	Winter Storm
Monroe County	01/17/2011	Winter Storm
Monroe County	02/01/2011	Winter Storm
Monroe County	03/22/2011	Winter Storm
Monroe County	12/26/2012	Winter Storm
Monroe County	02/08/2013	Winter Storm
Monroe County	03/18/2013	Winter Storm
Monroe County	12/14/2013	Winter Storm
Monroe County	02/05/2014	Winter Storm
Monroe County	02/12/2014	Winter Storm
Monroe County	11/26/2014	Winter Storm
Monroe County	02/01/2015	Winter Storm
Monroe County	01/23/2016	Winter Storm
Monroe County	02/09/2017	Winter Storm
Monroe County	03/14/2017	Blizzard
Monroe County	12/09/2017	Winter Storm

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County Winter Weather History		
Location	Date	Event Type
Monroe County	01/17/2018	Winter Storm
Monroe County	03/02/2018	Winter Storm
Monroe County	03/06/2018	Winter Storm
Monroe County	03/21/2018	Winter Storm
Monroe County	04/02/2018	Winter Storm
Monroe County	01/19/2019	Winter Storm
Monroe County	02/11/2019	Winter Storm
Monroe County	03/03/2019	Winter Storm
Monroe County	12/01/2019	Winter Storm
Monroe County	12/16/2019	Winter Storm
Monroe County	12/16/2020	Winter Storm
Monroe County	02/01/2021	Winter Storm
Monroe County	02/15/2021	Ice Storm
Monroe County	01/16/2022	Winter Storm
Monroe County	03/12/2022	Winter Storm
Monroe County	12/15/2022	Winter Storm
Monroe County	02/27/2023	Winter Storm
Source: NOAA NCEI, 2024		

4.3.9.4 Future Occurrence

Winter storm hazards in Pennsylvania are guaranteed yearly since the state is located at a relatively high latitudes resulting in winter temperatures that range between 0- and 32-degrees Fahrenheit for a good deal of the fall through early spring season (later October until mid-April). In addition, the state is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame. Based on historical snow related disaster declaration occurrences, the Commonwealth of Pennsylvania can expect a snowstorm of disaster declaration proportions, on average, once every three to five years. Similarly, for ice storms, based on historical disaster declarations, it is expected that on average, ice storms of disaster proportions will occur once every seven to ten years within the state.

Climate change could increase the intensity of winter storms in the northeastern United States and Monroe County, Pennsylvania. With warmer air temperatures, more moisture will be held in the air, and if the temperatures on the ground are below freezing, this could result in more snow falling during a weather event like a winter storm. These events may become less frequent as the climate warms, but they could be more intense.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.9.5 Vulnerability Assessment

Severe winter storms are of significant concern to Monroe County because of their frequency and magnitude in the region. Additionally, they are of significant concern due to the direct and indirect costs associated with these events; delays caused by the storms and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure and traffic accidents, and stress on community resources.

Every year, winter weather indirectly and deceptively kills hundreds of people in the United States, primarily from automobile accidents, over exertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding win-drive snow, drifting snow, extreme cold temperatures, and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Heavy accumulations of ice can bring down trees and powerlines, disabling electrical power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. The economic impact of winter weather each year is quite large, with costs for snow removal, damage, and loss of business in the millions each year. Heavy snow can immobilize and strand commuters as well as stopping the flow of supplies through an area or transportation corridor. In rural areas, homes and farms may be isolated for days and unprotected livestock may be lost. Bridges and overpasses are particularly dangerous because they freeze before other transportation surfaces. For the purposes of this Hazard Mitigation Plan, the entire population of Monroe County (168,128 as of the 2022 ACS) is exposed to severe winter storm events. The elderly are considered the most susceptible to this hazard due to their increased risk of injury and death from falls, overexertion, and or attempts to clear ice and snow. The elderly population is also more vulnerable to utility outages in winter, especially when they are paired with winter storm events. *Table 48 – Utility Outages in Monroe County in Winter* shows the number of power outages, phone outages, and 911 outages, that have occurred in the county during winter months. Vulnerable populations within Monroe County may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). The unsheltered populations of an area are at most risk to winter storm events.

The table below illustrates the number of citizens per municipality under the age of five or over the age of sixty-five years of age who are at an increased vulnerability to winter storms, and cascading hazards from winter storms:

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 47 - Population per Municipality under 5 Years or 65 Years or Older

Population per Municipality under 5 Years or 65 Years or Older				
Municipality	Number of People under 5 years of age	Percent of Population (%)	Number of People 65 years or older	Percent of Population
Barrett Township	181	4.5	738	18.2
Chestnuthill Township	913	5.5	3,140	18.7
Coolbaugh Township	1,110	5.3	3,385	16.3
Delaware Water Gap Borough	10	1.5	123	18.9
East Stroudsburg Borough	216	2.3	1,471	15.7
Eldred Township	159	6.0	608	22.9
Hamilton Township	271	3.1	1,988	23.1
Jackson Township	182	2.8	1,264	19.2
Middle Smithfield Township	879	5.5	2,364	14.7
Mount Pocono Borough	109	3.5	664	21.4
Paradise Township	278	9.5	386	13.2
Pocono Township	469	4.3	2,326	21.3
Polk Township	440	5.9	1,408	18.8
Price Township	191	5.2	586	15.9
Ross Township	269	4.9	1,315	23.9
Smithfield Township	138	1.7	1,118	14.1
Stroud Township	908	4.6	3,268	16.5
Stroudsburg Borough	288	4.9	1,868	31.7
Tobyhanna Township	384	4.6	1,289	15.5
Tunkhannock Township	395	5.6	1,411	20.1
Source: United States Census Bureau (USCB), American Community Survey (ACS), 2022				

Approximately 4.6% of the total population of Monroe County is under the age of five years old and approximately 18.3% of the total population is sixty-years old or older. In total, 22.9% of the population is at an increased risk from exposure to winter storm events and cascading hazards.

Table 48 - Utility Outages in Monroe County in Winter

Utility Outages in Monroe County in Winter			
Location	Start Date	End Date	Event
Tunkhannock Township	02/01/2021	02/02/2021	Phone/communications outage
Tunkhannock Township	03/04/2021	03/04/2021	Phone/communications outage
Tobyhanna Township	03/08/2022	03/09/2022	Phone/communications outage
Coolbaugh Township	12/25/2022	01/06/2023	Sanitary sewer overflow
Source: WebEOC™, Closed Incident Data 2024			

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

The entire general building stock inventory in Monroe County is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roof and building frames, rather than building content. There was no historic information available that identified property damages within Monroe County due to a single severe winter storm event. Current modeling tools are not available to estimate specific losses for this hazard. All of the historic and cultural properties in Monroe County are at similar vulnerability to severe winter storms. The properties include but are not limited to the Cool Spring Farm Springhouse, East Stroudsburg Armory, East Stroudsburg Railroad Station, John Michael Farm, Schoonover Mountain House, John Turn Farm, and the Zion Lutheran Church. The cultural aspects of Monroe County, including all five museums are also at an increased vulnerability to winter storms. These museums are the Antoine Dutot Museum and Gallery, the Frazetta Art Museum, the Quiet Valley Farm, the Schisler Museum and McMunn Planetarium, and the Stroud Museum Mansion. These museums are located throughout the county, specifically in Delaware Water Gap Borough, East Stroudsburg Borough, Hamilton Township, East Stroudsburg Borough at East Stroudsburg University, and Stroudsburg Borough.

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. At risk general building stock and infrastructure in floodplains are present in the flood profile due to snow and ice melt. Generally, losses from flooding associated with severe winter storms should be less than those associated with a 100-year or 500-year flood.

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Backup power is recommended critical infrastructure and facilities due to the potential for power interruption. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires infrastructure to clear roadways and alert citizens to dangerous conditions. In spring, this type of roadway damage must be repaired. Additionally, freezing rain and ice storms impact utilities (i.e., power lines and overhead utility wires) causing power outages for hundreds to thousands of residents.

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. However, because severe winter storms are a regular occurrence in this area, Monroe County is generally well-prepared for snow and ice removal each season.

Winter storm vulnerability is going to increase in Monroe County when climate change is considered. As mentioned above in Section 4.3.9.4, climate change is expected to increase the

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

intensity of winter storms. With warmer air temperatures, more moisture will be held in the air, and if temperatures on the ground rapidly decrease, or fall below freezing, this could result in more snow falling during a weather event like a winter storm. These events may become less frequent as the global temperatures increase, but they could become more intense.

As seen in *Table 3 – Population Change in Monroe County*, East Stroudsburg Borough, Middle Smithfield Township, Price Township, Smithfield Township, Stroud Township, Tobyhanna Township, and Tunkhannock Township have seen a net population increase from the 2010 decennial census to the 2020 decennial census. The impact that a winter storm can have on these municipalities will vary. Municipalities with an increase in population could have more resources available as well as personnel to mitigate the impacts that a winter storm can bring to one's community. A municipality that experienced a population decrease may not have these resources or personnel available to prepare for and mitigate against an impending winter storm. Adversely, municipalities with an increase in population could experience a more significant impact simply because they have more individuals being impacted compared to a smaller municipality. All municipalities within Monroe County are at the same level of risk to winter storms, but the direct and indirect impacts and vulnerability will vary by municipality.

Vulnerable, or underserved, populations within Monroe County may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). The unsheltered populations of an area are at the highest vulnerability to winter storm events. Individuals who are also in poverty, based on information provided in the United States Census are more likely to have issues meeting economic requirements for utility bills in the winter as well. All of these populations can be considered socially vulnerable or communities that have unmet needs.

Land use and major developments will have negligible impacts on the vulnerability of Monroe County to winter storm events. Land use may impact the response capabilities of Monroe County in a winter storm event, but changes in that land use will not increase the vulnerability. Monroe County has significant capabilities to respond to winter storm events. Major development in the county will need to be planned to allow for winter storm response, including size and makeup of transportation routes, and location of snow removal areas.

Winter storms may also negatively impact the natural resources in Monroe County. According to the Pennsylvania Department of Transportation, 446,991 tons of salt were used in the Commonwealth, including Monroe County, during the 2022 through 2023 winter storm weather season. Although the use of salt and other anti-skid materials protect life safety by improving roadway conditions, there can also be unintended consequences. When salt used on roadways

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

permeates the surrounding soil, it can infiltrate groundwater and contaminate wells. Hence, any groundwater sources near roadways, in Monroe County, may be vulnerable to degradation.

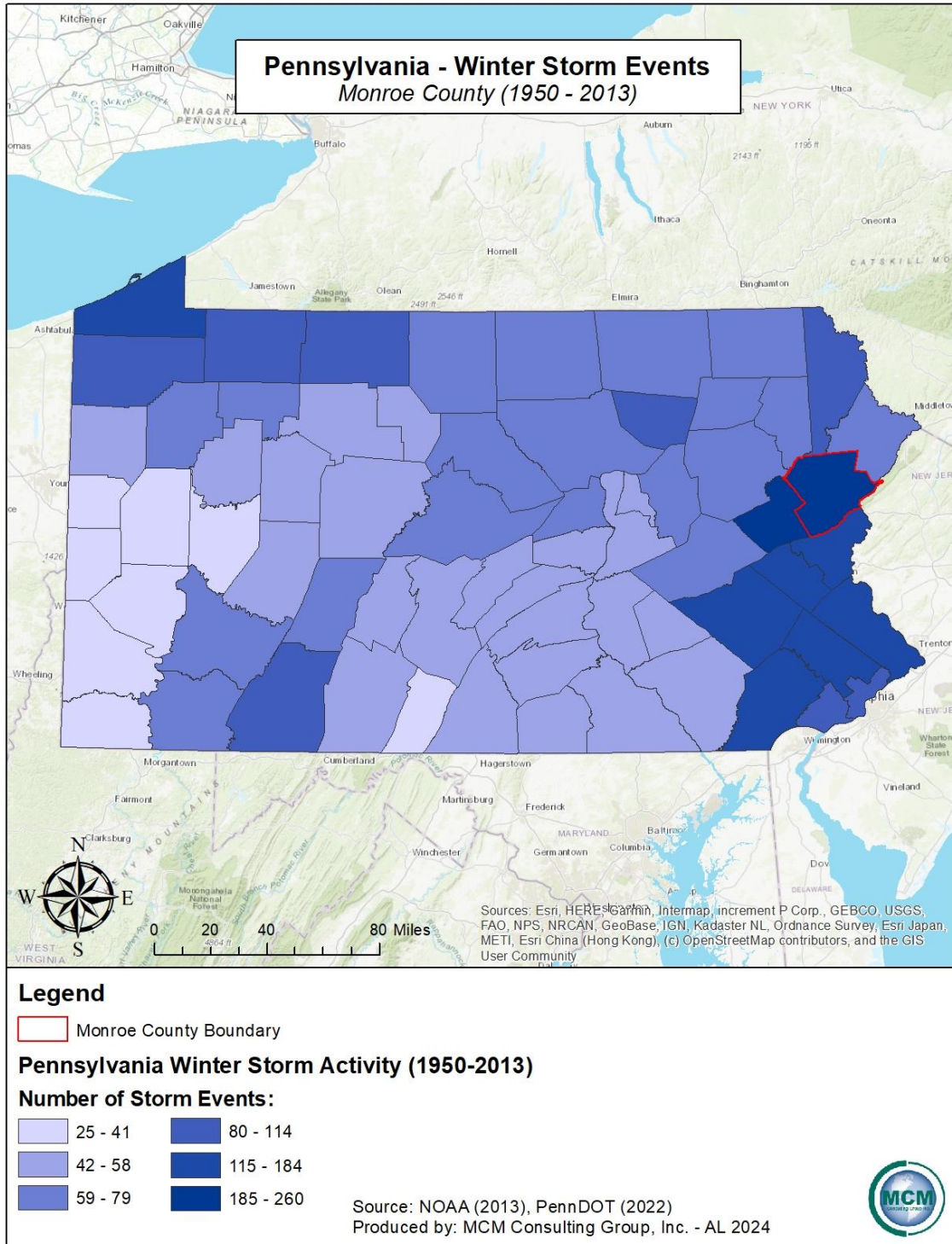
Roadway salt can also pose a risk to freshwater aquatic life near to the routes of transportation treated with the minerals. Salt that makes its way into soil or freshwater becomes a persistent hazard, damaging plants and wildlife that are not adapted to coexist with high salinity. Its persistent nature is due to a lack of any known biological system that can remove it from the environment in which it exists. Although it may be diluted with water, such a treatment would not be sufficient in isolation, and some intervention would likely be necessary to extract the salt from the environment which it pollutes.

The areas outlined by the public as being vulnerable to winter storms are as follows:

- Chestnuthill Township: The public outlined that the area at the intersection of Kresge Farm Road and Gilbert Road is vulnerable to increased winter storm issues.
- Jackson Township: The public outlined that the area around Jackson Road is vulnerable to winter storm impacts.

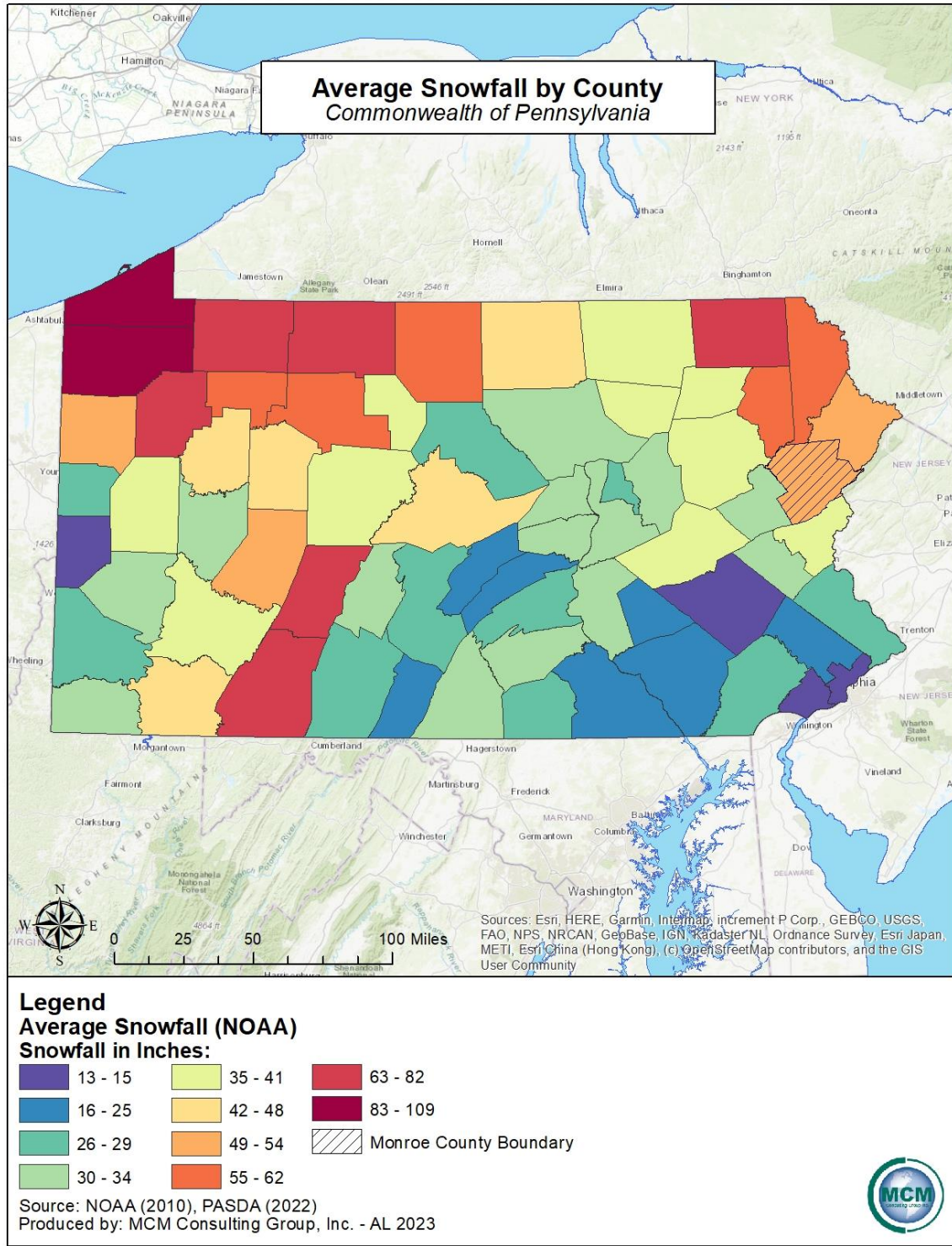
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 30 - Winter Storm Events by County in Pennsylvania



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 31 - Pennsylvania Annual Snowfall 1981 – 2010



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.10. Dam and Levee Failure

4.3.10.1 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.

Dam failures occur usually as a secondary effect of massive amounts of rainfall and flooding, causing too much water to enter the spillway system. This type of failure occurs with little to no warning. Spring thaws, severe thunderstorms, and heavy rainfall are also contributing factors to potential dam failures. Depending on the size of the body of water where the dam is constructed, additional water may come from distant upstream locations. Water contributions may also come from dam failures in adjoining counties that are along the same riverine or water features.

FEMA considers the following to be the most frequent causes of dam failures:

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

Poor engineering or poor maintenance may also cause dam failure. The Pennsylvania Department of Environmental Protection (PA DEP) and the United States Army Corps of Engineers (USACE) awards permits for dams and also share inspection responsibilities. Inspection results are characterized as either safe or unsafe.

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 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) There are forty-three high-hazard and twenty-one low-hazard dams in Monroe County that are both publicly and privately owned and are registered with the USACE in the NID. There are also thirteen dams with a hazard classification as significant. There are forty-two dams within the county that are high-hazard and require an emergency action plan. *Table 50 –*

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Monroe County Dam Inventory illustrates the dams located in Monroe County. *Table 49 – High-Hazard Dams Municipality Summary* summarizes the high-hazard dams in Monroe County by municipality. The municipalities not listed do not have high-hazard dams. *Table 51 – Dam Name and Purpose* lists the dams located in Monroe County and their purpose code, and the description of purpose based on the Pennsylvania DEP codes.

Table 49 - High-Hazard Dams Municipality Summary

High-Hazard Dams – Municipal Summary	
Municipality	Number of High-Hazard Dams
Barrett Township	4
Coolbaugh Township	3
Jackson Township	3
Middle Smithfield Township	4
Paradise Township	3
Polk Township	3
Price Township	1
Smithfield Township	7
Stroud Township	4
Tobyhanna Township	8
Tunkhannock Township	3
Total:	43
Source: NID, 2024	

Table 50 - Monroe County Dam Inventory

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Alpine Lake	TR Butz Run	Alpine Lake Lot Owners Assoc. INC.	1962	11	0.6	L	NR
Analomink Lake	TR Brodhead Creek	Analomink Rod & Gun Club, INC.	1910	11	1.3	S	Y
Arrowhead Lake	Trout Creek	Arrowhead Lake Community Assoc. INC.	1954	18	14.74	H	Y

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Blue Mountain Lake	TR Brodhead Creek	Blue Mountain Lake Assoc.	1908	9	1.1	H	Y
Bradys Lake	TR Trout Creek	PA Game Commission	2007	18.5	7.49	H	Y
Brier Crest Woods	TR Tunkhannock Creek	Brier Crest Woods Property Owners Assoc.	1973	16	0.5	H	Y
Browns Lake	Stony Run	Carl & Holly Martin	1925	18	2.4	H	Y
Crawford Lake	Paradise Creek	Paradise Falls Lutheran Assoc.	1938	20.5	13	H	Y
Crescent Lake	Pocono Creek	Crescent Lake Assoc.	1957	14	0.54	L	NR
Dormoy Lake	TR Stony Run	Daniel W. Keuler	1930	20	0.14	U	NR
East Stroudsburg	Sambo Creek	Borough of East Stroudsburg	1936	48	1.68	H	Y
Easton Anglers	Wilkenson Run	Easton Anglers Assoc.	1929	10	1.6	L	NR
El-Do Lake	TR Dotters Creek	El Do Lake Property Owners Assoc. INC.	N/a	13	0.27	H	Y
Flagler	Flagler Run	Olde Mill Run Property Owners Assoc.	1915	19	1.6	L	NR
Goose Pond Run (PA-464)	Goose Pond Run	Monroe County Commissioners	1975	97	6.8	H	Y

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Gregory Pond	Zacharias Run	Borough of East Stroudsburg	1922	8	14	L	NR
Grubers Lake	Appenzell Creek	Carlos R. Gruber	1928	12	4	L	NR
Hallowood Acres	Leas Creek	Hallowood Acres Homes Assoc.	1970	31	1.07	H	Y
Hemlock Lake	TR Pohopoco Creek	Hemlock Lake P.O.A.	1950	32.5	0.48	H	Y
Hidden Lake Dam	N/a	DOI NPS	1928	9		S	Y
Hunter Lake	Rocky Run	Golden Slipper Club Camp	1928	13	2.1	S	Y
Indian Mountain Lake	Mud Run	Indian Mountain Lake Civic Assoc.	1960	13	2.7	H	Y
Lake Akiba	TR Appenzell Creek	Akiba CA, LP	1926	22	3.4	H	Y
Lake Lenape	Goose Pond Run	Camp Canadesis, INC.	1901	10	4.1	L	NR
Lake Minausins	Swiftwater Creek	Pocono Manor, INC.	1903	20	3.4	L	NR
Lake Naomi	Upper Tunkhannock Creek	Lake Naomi Club	1895	14	19.5	H	Y
Lake Sinca	TR Two Mile Run	Green Wood Acres P.O.A.	1969	24	0.45	H	Y
Lake Swiftwater	Swiftwater Creek	Lake Swiftwater Club, INC.	1930	31	9.68	H	Y

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Lake Trexler	Middle Creek	Boy Scouts of America	1962	25	1.9	L	NR
Lake Watawah	Lake Creek	George Leshanski	1922	19	3.8	L	NR
Lakeview Pond	TR Bushkill Creek	Theresa's Lakeview Bar & Grill	1975	7	0.4	S	Y
Leavitt Branch (PA-463)	Leavitt Branch Brodhead Creek	Monroe County Commissioners	1976	90	6.52	H	Y
Lenape Lake	Spring Run	Camp Pinemere	1927	8	0.5	L	NR
Lindenmere	TR Pocono Creek	Camp Lindenmere, INC.	1935	12	0.49	S	Y
Locust Lake	TR Trout Creek	Locust Lake Village Property Owners Assoc.	N/A	12	0.42	H	Y
Lower	Sambo Creek	Borough of East Stroudsburg	1921	24	3	L	NR
Lower Lake	Leavitt Branch Brodhead Creek	Skytop Lodge, INC.	1923	30	5	L	NR
Manzanedo	Stone Mountain Run	Manzanedo Rod & Gun Club	1914	12	0.5	L	NR
Marshall Lake	Pond Creek	Khan F. Mohammad	1904	9	7.88	H	Y
Meadow Lake	TR Pond Creek	Meadow Lake Fishing Club	1916	14	4.3	S	Y

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Middle	Sambo Creek	Borough of East Stroudsburg	1922	24	2.7	H	Y
Monroe Lake	Bear Swamp Run	Monroe Lake P.O.A.	1926	12	1.1	H	Y
Mount Airy	Forest Hills Run	Mt. Airy Casino Resort	1974	42	2.57	H	Y
Mountain Springs Dike	Appenzell Creek	Jack B. Rader	1919	8	2.6	U	NR
Mountain Springs Lake	Appenzell Creek	Jack B. Rader	1919	18	2.6	H	Y
Mountaintop Lake #1	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1993	24	1.02	H	Y
Mountaintop Lake #2	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1993	12	1.02	H	Y
Naus and Newlyn	Dresser Run	Pocono Country Place Assoc.	1968	20	1.82	L	NR
NO 1	Tobyhanna Creek	Miss Hitt Marilou Etal	N/A	8	13.9	L	NR
North Arrowhead Lake	TR Trout Creek	Arrowhead Lake Community Assoc. INC.	1971	21	1	H	Y
Pinecrest Lake (Tamaque Lake)	Beaver Creek	Pine Crest Lake Community Trust	1927	19	1.88	H	Y
Pinetree Lake	Dry Sawmill Run	Emerald Lakes Assoc. INC.	1972	25	1.5	H	Y

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Pleasant Valley Estates	TR Jonas Creek	Pleasant Valley Estates Civic Assoc.	2009	14	0.43	H	Y
Pocahontas	TR Brodhead Creek	Pocahontas Rod & Gun Club	1911	13	0.41	H	Y
Pocono Highlands	TR Pond Creek	JNS Holdings	1928	20	1.1	H	Y
Pocono Lake	Tobyhanna Creek	Pocono Lake Preserve	1957	47	75	S	Y
Pocono Laurel Lake	TR Pocono Creek	Pocono Laurel Lake, P.O.A.	N/A	11	0.38	S	N
Robert Christman	TR Brodhead Creek	Robert L. Christman, II	N/A	13	0.5	H	N
Shawnee Lake	Shawnee Creek	Shawnee Development, INC.	1927	22	3.8	H	Y
Shawnee Pond	Shawnee Creek	Ski Shawnee, INC.	2008	10.5	2.47	S	Y
Skytop	Leavitt Branch Brodhead Creek	Skytop Lodge, INC.	1930	19	5.7	H	Y
Spring Lake	TR Brodhead Creek	Spring Lake Homeowners Assoc.	1983	22	0.17	H	Y
Springwater Lake	TR Sambo Creek	Twin Lake Estates P.O.A. INC.	2009	10	0.22	H	Y
Stillwater Lake	Upper Tunkhannock Creek	BSA Minsi Trail Council	1900	8	13.3	H	Y
Stony Garden Reservoir	Ross Common Creek	PA American Water Company	1912	26	1.8	L	NR

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Dams							
Dam Name	River	Owner Name	Year Completed	Dam Height (feet)	Drainage Area (acres)	Hazard	EAP
Summit Lake No. 1	Red Run	Stillwater Lake Civic Assoc. INC.	1919	8	0.9	S	Y
Summit Lake No. 2	Red Run	Delaware Lackawanna Railroad Co. INC.	1919	10	0.7	L	NR
Sun Mountain Lake	Shawnee Creek	Shawnee Development, INC.	1934	12.5	3.62	H	Y
Sweetwater Lake	TR Sambo Creek	Twin Lake Estates P.O.A. INC.	1983	8	N/a	H	N
Thomas	TR Stony Run	Marcia M. Thomas	1982	10	0.69	S	Y
Tobyhanna No. 2	Tobyhanna Creek	DCNR	1951		8.76	H	Y
Trout Lake	Appenzell Creek	Chase Mutual, INC.	1900	24	3.7	H	Y
Werrys Lake	TR Sand Hill Creek	Lake of the Pines Community Assoc. INC. Management Agent	1929	12	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	16	1.5	H	Y
Witmer	Cherry Creek	Eastwood Farm	1941	9	1.1	L	NR
Wolf Swamp Run	Wolf Swamp Run	PA Game Commission	N/a	14	0.98	L	NR
Source: NID, 2024							

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 51 - Dam Name and Purpose

Monroe County Dams and Purposes		
Dam Name	Purpose Code	Purpose Code Description
Alpine Lake	R	Recreation
Analomink Lake	R	Recreation
Arrowhead Lake	R	Recreation
Blue Mountain Lake	R	Recreation
Brady's Lake	R	Recreation
Brier Crest Woods	R	Recreation
Browns Lake	R	Recreation
Crawford Lake	R	Recreation
Crescent Lake	R	Recreation
Dormoy Lake	R	Recreation
East Stroudsburg	S	Water Supply
Easton Anglers	R	Recreation
El-Do Lake	R	Recreation
Flagler	R	Recreation
Goose Pond Run (PA-464)	C	Flood Risk Reduction
Gregory Pond	O	Other
Grubers Lake	R	Recreation
Hallowood Acres	R	Recreation
Hemlock Lake	R	Recreation
Hidden Lake Dam	F	Fish and Wildlife
Hunter Lake	R	Recreation
Indian Mountain Lake	R	Recreation
Lake Akiba	R	Recreation
Lake Lenape	R	Recreation
Lake Minausin	R	Recreation
Lake Naomi	R	Recreation
Lake Sinca	R	Recreation
Lake Swiftwater	R	Recreation
Lake Trexler	R	Recreation
Lake Watawah	R	Recreation
Lakeview Pond	R	Recreation
Leavitt Branch (PA-463)	C	Flood Risk Reduction
Lenape Lake	R	Recreation
Lindenmere	R	Recreation
Locust Lake	R	Recreation
Lower	R	Recreation
Lower Lake	R	Recreation
Manzanedo	R	Recreation
Marshall Lake	R	Recreation
Meadow Lake	R	Recreation
Middle	S	Water Supply

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County Dams and Purposes		
Dam Name	Purpose Code	Purpose Code Description
Monroe Lake	R	Recreation
Mount Airy	R	Recreation
Mountain Springs Dike	R	Recreation
Mountain Springs Lake	R	Recreation
Mountaintop Lake #1	R	Recreation
Mountaintop Lake #2	R	Recreation
Naus and Newlyn	R	Recreation
NO 1	O	Other
North Arrowhead Lake	R	Recreation
Pinecrest Lake (Tamaque Lake)	R	Recreation
Pinetree Lake	R	Recreation
Pleasant Valley Estates	R	Recreation
Pocahontas	R	Recreation
Pocono Highlands	R	Recreation
Pocono Lake	H	Hydroelectric
Pocono Laurel Lake	R	Recreation
Robert Christman	R	Recreation
Shawnee Lake	R	Recreation
Shawnee Pond	S	Water Supply
Skytop	R	Recreation
Spring Lake	R	Recreation
Springwater Lake	R	Recreation
Stillwater Lake	R	Recreation
Stony Garden Reservoir	S	Water Supply
Summit Lake No. 1	R	Recreation
Summit Lake No. 2	R	Recreation
Sun Mountain Lake	R	Recreation
Sweetwater Lake	R	Recreation
Thomas	R	Recreation
Tobyhanna No. 2	R	Recreation
Trout Lake	R	Recreation
Werrys Lake	R	Recreation
White Heron	R	Recreation
Wigwam Lake	R	Recreation
Witmer	R	Recreation
Wolf Swamp Run	R	Recreation
Source: PA DEP 2019 & NID 2024		

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

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

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 property 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 protecting areas from flooding. The National Levee Database (NLD), like its counterpart of the National Inventory of Dams (NID), is maintained by the USACE and tracks levees across the United States. Monroe County is home to three levee sections, which are detailed in *Table 52 – Monroe County Levee Inventory*.

Table 52 - Monroe County Levee Inventory

Monroe County Levee Inventory		
Levee Name	Levee Type	Levee Length (miles)
East Stroudsburg- Downstream	Earthen Embankment	0.55
East Stroudsburg-Upstream	Earthen Embankment	1.22
Stroudsburg	Earthen Embankment	1.28
Source: NLD, 2024		

4.3.10.2 Range and Magnitude

Dams

Dam failures can pose a serious threat to communities located downstream from 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. *Figure 32 – Monroe County Dams* shows the location of dams within Monroe County, as well as their hazard designation.

Levees

Levee failure 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 exceeded the levee specifications. Additionally, levees can also fail if they are allowed to deteriorate or decay. Regular maintenance of levees is critical. *Figure*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

33 – *Monroe County Levee Locations* illustrates areas protected by the Monroe County levee systems. The figures following *Figure 34 – Levee Locations – Stroudsburg and East Stroudsburg* illustrate areas around Stroudsburg Borough and East Stroudsburg Borough that are heavily protected by levees.

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 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.

4.3.10.3 Past Occurrence

Dams

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

There have been a few historically destructive dam failures in Pennsylvania over the course of the past two hundred years. The most destructive dam failure in United States history took place in Johnstown, Pennsylvania (Cambria County) in 1889, claiming 2,209 lives. Another significant dam failure took place in Austin, Pennsylvania (Potter County) in 1911, claiming seventy-eight lives. Similarly, a dam failure in West Taylor Township, Pennsylvania (Cambria County) claimed the lives of forty people when the Laurel Run Dam, No. 2 failed during the Johnstown Flood in the early morning hours of July 20th, 1977.

Levees

The National Levee Database (NLD) lists no occurrence of levee failures or major incidents occurring in Monroe County.

Some of the worst levee failures in the history of the United States have occurred in the American South, along parts of the Mississippi River delta. Levee failures in New Orleans, Louisiana during Hurricane Katrina from August 23 to August 31, 2005 resulted in an enormous amount of property damage and loss of lives. There were approximately fifty-three levee failures in constructed levees around the City of New Orleans. Hurricane Katrina precipitated the

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

creation of more strict levee requirements for inspection and construction on the local, state, and federal level.

4.3.10.4 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 those categories such as slope stability, undermining seepage, and spillway adequacy. With more strict construction and design procedures in place, the future occurrence of a dam failure is increasingly small. The new procedures and rules protect public safety and both public and private property. Newly constructed dams are thoroughly examined by professional engineers to prevent future dam failure events.

Levees

Although levee failures can occur at any 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.

4.3.10.5 Vulnerability Assessment

Dams

Property and populations located downstream from any dams are vulnerable to dam failures. The Pennsylvania Code (§105.91 Classification of dams and reservoirs) classifies doth dams by size and the amount of loss of life and economic loss expected in a failure event. *Table 53 – Dam*

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 indicator, since that will indicate the level of potential substantial loss of life and excessive economic loss.

Table 53 - Dam Classification

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

Dam 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 with low slope stability. The economic and financial impact from damage and recovery ranges from minimal to severe, depending on the magnitude of damage and scale of failure event.

Emergency action plans are developed by the owners of high-hazard dams. These plans are then disseminated to first responders and other planning partners within the county. Vulnerable populations are those residents and businesses located downstream from a high-hazard dam within the inundation area. The emergency action plan identifies a call list to notify downstream at-risk populations. Emergency action plan exercises are held every five to seven years depending on local policy.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

The characteristics of the forty-three high-hazard dams in Monroe County vary greatly. The Lake Naomi Dam, located in Tobyhanna Township, has the largest drainage area with a total of 19.5 acres. The dams that were constructed most recently are the Pleasant Valley Estates, located in Polk Township, which was constructed in 2009, and the Springwater Lake Dam, located in Smithfield Township, which were constructed in 2009. The dam that is the oldest in the county is Lake Naomi Dam, which was constructed in 1895. The Leavitt Branch (PA-463) is the tallest in the county with a height of ninety feet. Emerald Lakes Assoc. INC. owns the most dams in Monroe County with a total of three dams. The dams in Monroe County are owned by a mix of public and private owners and vary in almost every aspect. The county dams are distributed relatively evenly throughout the county and municipalities, with an even mix of high and low hazard dams in the municipalities.

Levees

Each levee that is located in Monroe County is of different length and each protects areas from a different section of waterway and flood way. Stroudsburg Levee is the largest in Monroe County with a length of 1.28 miles. The East Stroudsburg- Downstream levee is the smallest in length in Monroe County with a length of 0.55 miles.

The entire leveed areas for Monroe County protect a total of 852 structures within the county. Also protected are seven facilities with Monroe County that includes community lifeline facilities (municipal buildings, hospitals, police/fire/EMS, schools, childcare centers, and nursing/care homes) facilities. Especially vulnerable are one electric substation, two grocery stores, two historic buildings, one police department, and one sewage treatment plant. Each levee in Monroe County is a mainline levee and protects along a variety land feature. A failure of levee in the urban areas in Monroe County would be catastrophic to life and property.

There are a large number of community lifeline facilities within the levee protection areas for the levees around Monroe County. *Table 54 – Number of Vulnerable Structures within Leveed Areas* shows the number of addressable structures and facility type points in the largest levee protection areas within Monroe County based on NLD information from 2024. The features included in the table are particularly vulnerable to levee failure because they are protected by the system. Should the levee systems fail, the structures would be at an increased risk by their flood sources.

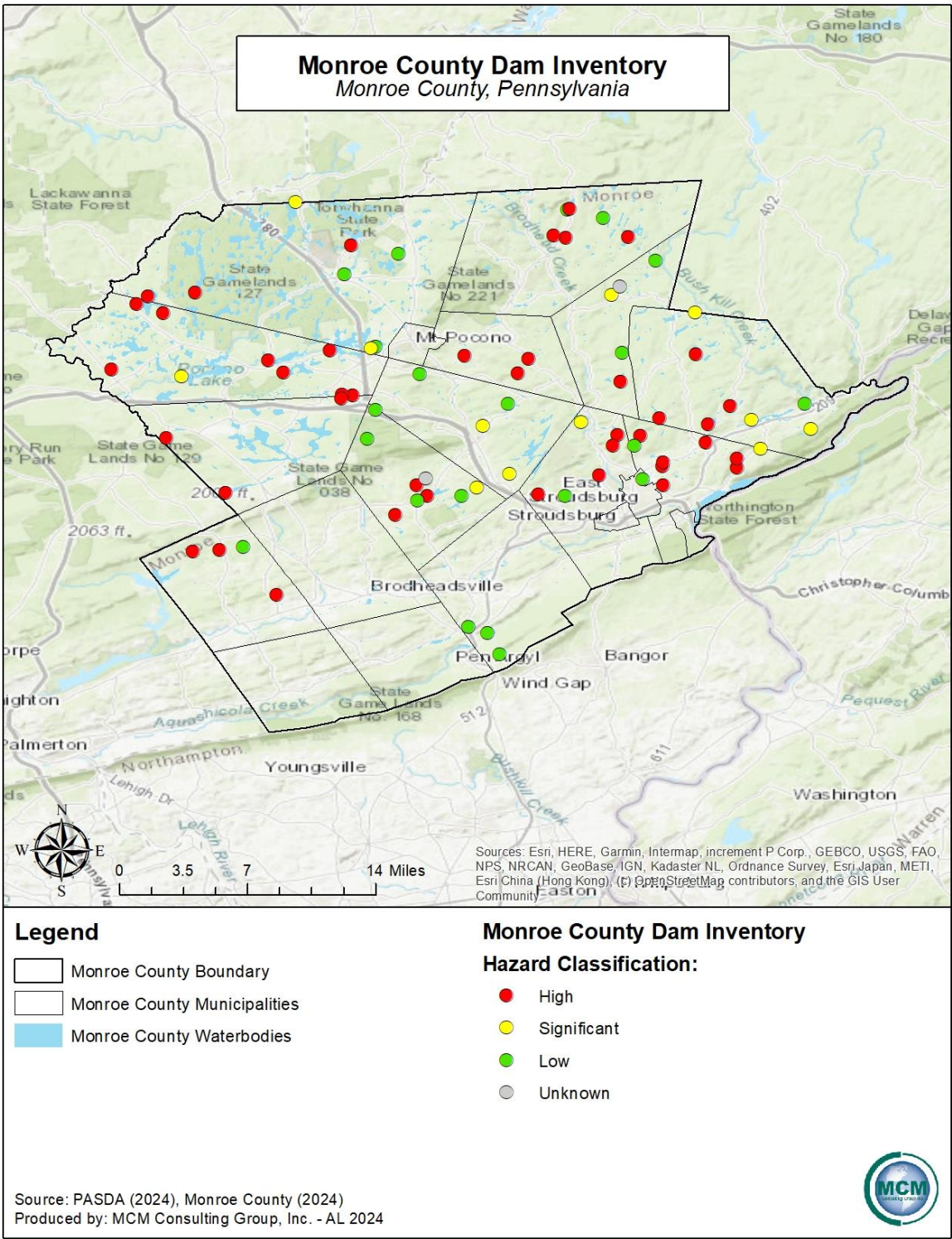
***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Table 54 - Number of Vulnerable Structures within Leveed Areas

Number of Vulnerable Structures within Leveed Areas		
Leveed Area Name	Addressable Structures in Leveed Area	Facility Type Points in Leveed Area
East Stroudsburg – Downstream	59	3
East Stroudsburg – Upstream	393	1
Stroudsburg	400	3
Totals:	852	7

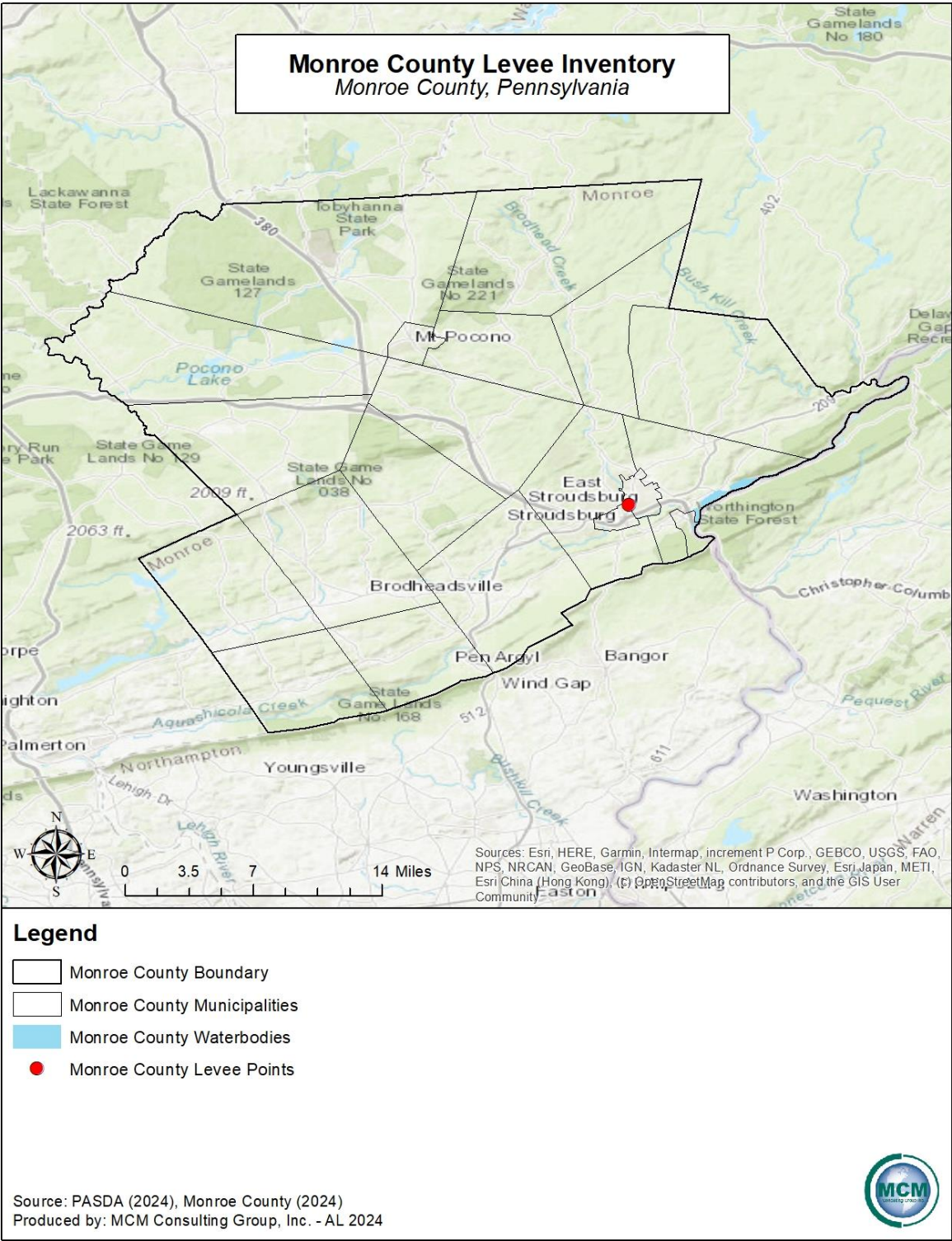
Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Figure 32 - Monroe County Dams



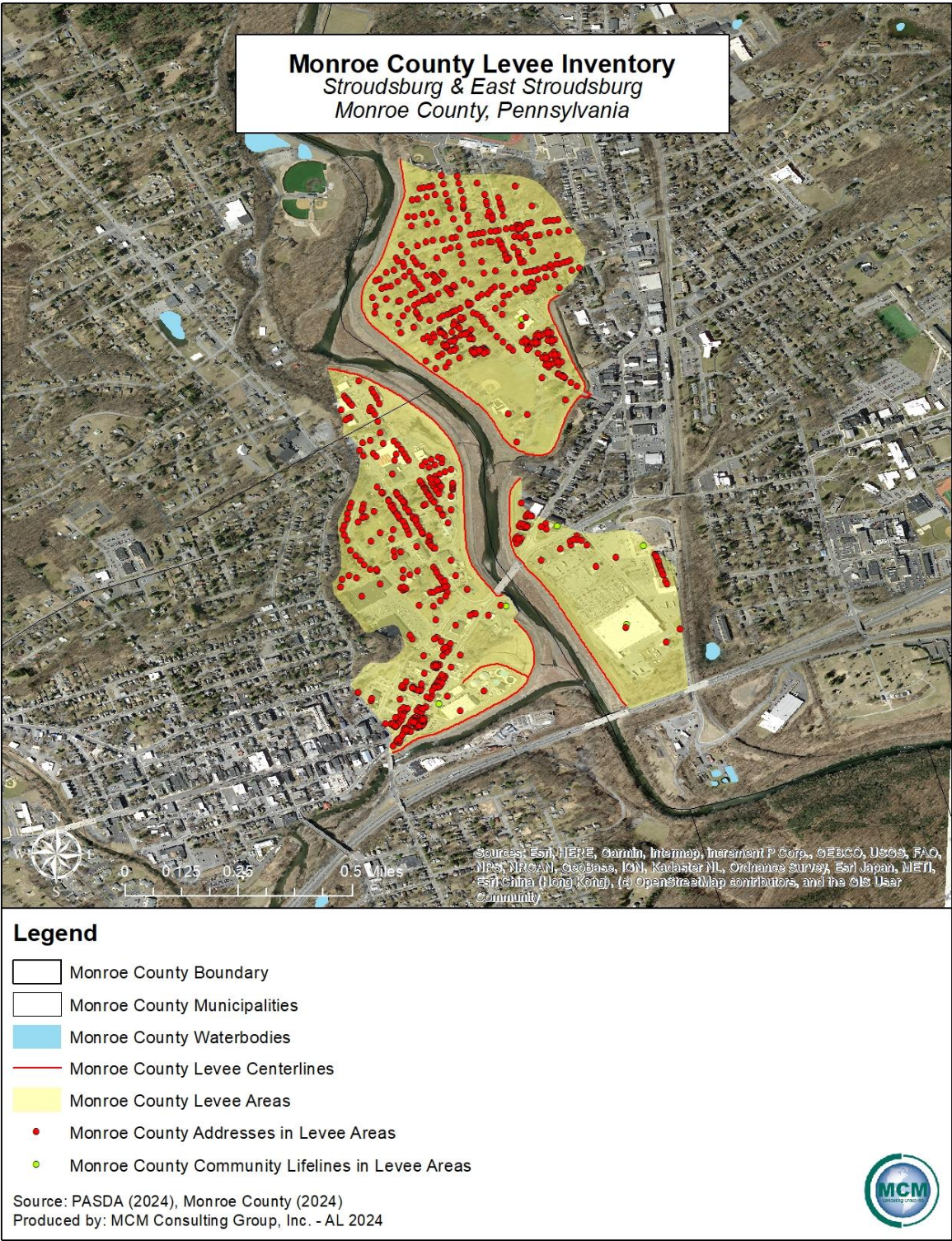
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 33 - Monroe County Levee Locations



Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Figure 34 - Levee Locations – Stroudsburg and East Stroudsburg



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.11. Disorientation

4.3.11.1 Location and Extent

Many people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. People can become lost or trapped in remote and rugged wilderness areas, as a result. Monroe County has several parks and large forested areas that may attract locals and tourists due to the natural appeal of the landscape and the expanses of land, both state-owned and otherwise. Monroe County is home to three state parks which are Gouldsboro State Park, Tobyhanna State Park, and Big Pocono State Park as well as several state game lands. In the event of disorientation, 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 often focused in and around state forest and state park lands as they contain numerous miles of hiking and biking trails.

4.3.11.2 Range of Magnitude

Approximately 79% of land use in Monroe County is forest areas that can be credited for streams and drinking water (Plan for Clean Water Monroe County, PA). 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 a limited amount of water (8.97 square miles of water area), and during the warmer summer months shelter is less of a necessity than during winter months when extreme cold poses a threat. Age, physical fitness, and familiarity with the area can also have a bearing on the outcome.

Initial search and rescue efforts are often made with teams of dogs, people on horseback, and or volunteers from fire departments, and for longer term incidents drones may be employed.

4.3.11.3 Past Occurrence

Wilderness search and rescue often requires considerable resources, sometimes resulting in the expenditure of hundreds of man-hours, both paid and volunteer. Monroe County utilizes a database system called WebEOC to track various incidents within the county. This system tracks many incidents that have occurred throughout the county. Specifically, search and rescue incidents that occurred in Monroe County have been recorded. All search and rescue operations that have been recorded in WebEOC can be seen in *Table 55 – Search and Rescue Operations in Monroe County 2021 to 2024*. These incidents reflect a disoriented individual that needed assistance to return to safety and a place of familiarity.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 55 - Search and Rescue Operations in Monroe County 2021 to 2023

Search and Rescue Operations in Monroe County 2021 to 2023			
Start Date	End Date	Event	Location
01/13/2021	01/13/2021	Water Rescue	Stroud Township
02/14/2021	02/14/2021	Search and Rescue – Missing Person	Stroud Township
04/10/2021	04/14/2021	Search – Missing Person	Coolbaugh Township
04/14/2021	04/20/2021	Search and Rescue – Missing Person	Stroud Township
06/04/2021	06/05/2021	Search and Rescue – Wilderness Rescue	East Stroudsburg Borough
06/12/2021	06/12/2021	Search and Rescue – MEPA*	Stroud Township
06/22/2021	06/22/2021	Water Rescue	Coolbaugh Township
07/12/2021	07/12/2021	Search Operation – Missing Person	Smithfield Township
08/18/2021	08/18/2021	Search and Rescue – Missing Person, MEPA*	Pocono Township
08/21/2021	08/21/2021	Water Rescue	Smithfield Township
10/17/2021	10/17/2021	Search and Rescue – Trail Rescue	Barrett Township
10/24/2021	10/24/2021	Search and Rescue – Wilderness Rescue	Barrett Township
10/25/2021	10/27/2021	Search and Rescue – Missing Person, MEPA*	Middle Smithfield Township
04/14/2022	04/15/2022	Search and Rescue – Missing Person, MEPA*	Eldred Township
04/25/2022	04/27/2022	Search and Rescue – Missing Person, MEPA*	Chestnuthill Township
05/05/2022	05/05/2022	Water Rescue	Stroudsburg Borough
05/21/2022	05/21/2022	Search/Water Rescue	Price Township
05/29/2022	05/29/2022	Water Rescue	Delaware Water Gap Borough
06/21/2022	06/22/2022	Water Rescue/Possible Drowning	Smithfield Township
07/27/2022	07/28/2022	Search – Missing Person	Smithfield Township
10/07/2022	10/07/2022	Water/Terrain Recovery	Stroud Township
10/22/2022	10/22/2022	Search and Rescue	Hamilton Township
03/05/2023	03/05/2023	Search – Missing Person	Tobyhanna Township
03/11/2023	03/11/2023	Search and Rescue – High Angle/Cliff	Delaware Water Gap Borough
07/13/2023	07/14/2023	Water Rescue	Smithfield Township
07/19/2023	07/19/2023	Water Rescue	Delaware Water Gap Borough
08/19/2023	08/19/2023	Drowning	Coolbaugh Township
10/28/2023	10/29/2023	Search – Missing Person	Hamilton Township
11/23/2023	11/23/2023	Water Rescue	Tunkhannock Township

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Search and Rescue Operations in Monroe County 2021 to 2023			
Start Date	End Date	Event	Location
12/13/2023	12/14/2023	Search and Rescue – Missing Person, DWG A/T Search	Delaware Water Gap Borough
02/14/2024	02/15/2024	Search and Rescue – Missing Person	Price Township
03/03/2024	03/03/2024	Search and Rescue – MEPA*	
Source: WebEOC, Closed Incident Data (2024)			
Note: MEPA* - Missing Endangered Person Advisory			

4.3.11.4 Future Occurrence

During the warm summer months, as activities such as hiking, biking, and camping increase, so does the likelihood of individuals becoming disoriented. Many search and rescue events also occur in November due to individuals getting lost during hunting season. Disorientation occurs most often in state parks and state forests where outdoor recreation is most abundant, and the woods are most dense. Additionally, medical emergencies occur regularly in the county, especially among the elderly, which could result in disorientation events.

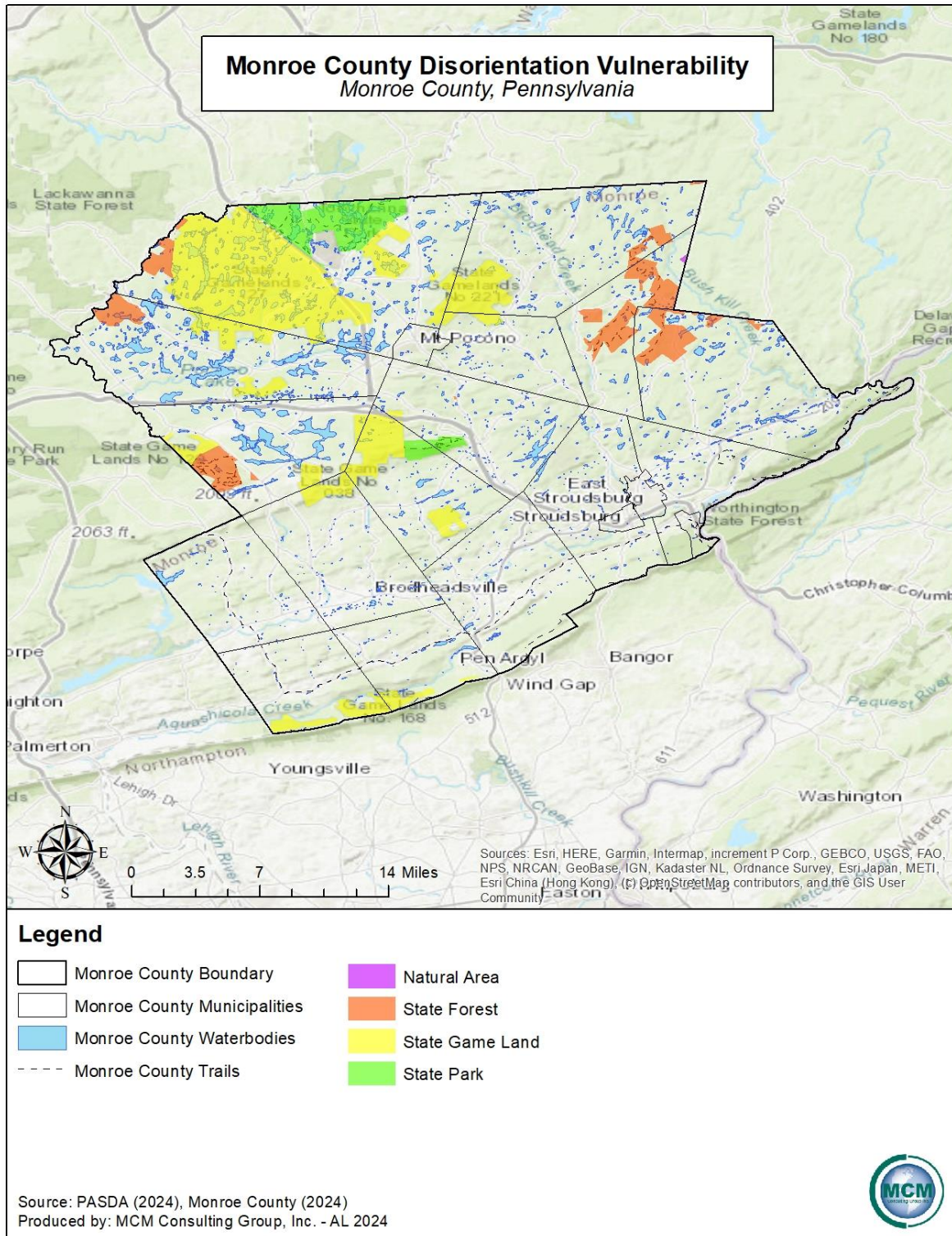
4.3.11.5 Vulnerability Assessment

Individuals are most likely to become disorientated in areas of vast, open wilderness. Children and the elderly are most vulnerable to exposure to the elements. The elderly tend to be more vulnerable to disorientation due to medical/mental related issues that may occur outside of rugged terrain. Often, an individual with dementia or Alzheimer's may become disoriented in residential or wilderness locations.

The most dangerous period to become lost outdoors is during the winter months when heat and shelter are vital. Monroe County regularly experiences winter storms and temperatures below freezing, so persons participating in outdoor recreational activities in the winter are at a higher risk in the event of disorientation. *Figure 35 – Monroe County Disorientation Vulnerability* identifies areas within the county that are most vulnerable to disorientation.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 35 - Monroe County Disorientation Vulnerability



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.12. Drowning

4.3.12.1 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 Gouldsboro State Park, Tobyhanna State Park, and Big Pocono State Park. 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 4.3.12.5 of this hazard mitigation plan.

4.3.12.2 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 one to nineteen. According to the Center for Disease Control (CDC) 2021, from 2011-2020, there was an average of 4,012 deaths each year in the United States due to unintentional drownings (non-boating related). An additional 332 people die each year from drowning in boating-related incidents. In 2021, 658 boating-related deaths were reported by the U.S. Coast Guard. The CDC also reports that about one in five people who die from drowning are children fourteen years of age and younger. And, for every child who dies from drowning, another seven receive emergency department care for nonfatal submersion injuries. Of those that are treated in emergency departments for submersion injuries, more than 40% 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.

4.3.12.3 Past Occurrences

The records of past occurrences of drowning were difficult to identify. *Table 56 – Water Rescue/Drownings in Monroe County 2021 to 2023* identifies incidents of drowning, near drowning, and water rescues in Monroe County from 2021 to 2023 as identified from WebEOC.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 56 - Water Rescue/Drownings in Monroe County 2021 to 2023

Water Rescue/Drownings in Monroe County 2021 to 2023			
Start Date	End Date	Event	Location
01/13/2021	01/13/2021	Water Rescue	Stroud Township
06/22/2021	06/22/2021	Water Rescue	Coolbaugh Township
08/21/2021	08/21/2021	Water Rescue	Smithfield Township
05/05/2022	05/05/2022	Water Rescue	Stroudsburg Borough
05/21/2022	05/21/2022	Search/Water Rescue	Price Township
05/29/2022	05/29/2022	Water Rescue	Delaware Water Gap Borough
06/21/2022	06/22/2022	Water Rescue/Possible Drowning	Smithfield Township
10/07/2022	10/07/2022	Water/Terrain Recovery	Stroud Township
07/13/2023	07/14/2023	Water Rescue	Smithfield Township
07/19/2023	07/19/2023	Water Rescue	Delaware Water Gap Borough
08/19/2023	08/19/2023	Drowning	Coolbaugh Township
11/23/2023	11/23/2023	Water Rescue	Tunkhannock Township
Source: WebEOC, Closed Incident Data (2024)			

4.3.12.4 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.

4.3.12.5 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 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 36 – Drowning Hazards – Water Features reflects the vulnerability for drowning in Monroe County.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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.

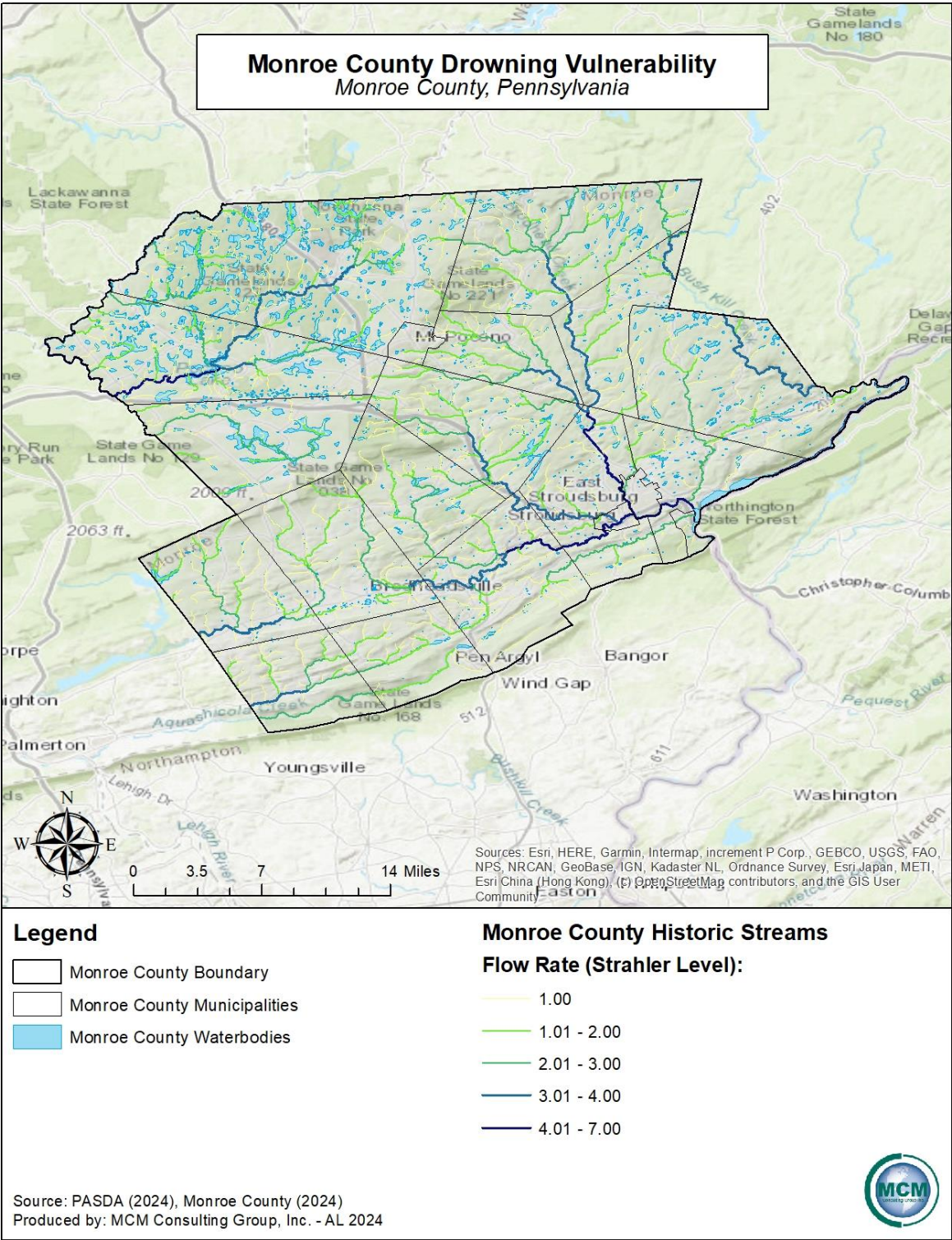
While participating in winter sports such as ice skating, ice fishing, or sledding participants must check the ice layer. Determining the safety of ice can be accomplished by assessing the following factors together:

- 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.

The public outlined that there was at least one drowning incident in Monroe County, specifically in Stroud Township. This location was outlined as being located near Cherry Lane and Brodhead Creek. This is not the only location in Monroe County that is vulnerable drowning incidents, but it is the one outlined in the public outreach.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 36 - Drowning Hazards – Water Features



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.13. Environmental Hazards

4.3.13.1 Location and Extent

Transportation

Environmental hazards are most commonly due to hazardous materials incidents occurring when such materials are manufactured, used, stored, or transported. Most hazardous materials incidents are unintentional, however hazardous materials could also be released in a criminal or terrorist act. A release, whether it is intentional or accidental, can result in injury or death and may contaminate air, water and/or soils. Hazardous materials incidents can be generally broken down into the subcategories of transportation and fixed facility. This section will focus on environmental hazards and how they relate to transportation of hazardous materials.

Tanker trucks, tractor trailers, and rail cars often are used to transport hazardous materials. When there are transportation incidents involving these types of vehicles, hazardous materials can be released in significant quantities. *Figure – Environmental Hazard Transportation Vulnerability* shows major transportation routes through Monroe County, including Interstate 80, I-380, US 209, PA 33, PA 115, PA 191, PA 314, PA 390, PA 402, PA 423, PA 435, PA 447, PA 507, PA 534, PA 611, PA 715, PA 903, and PA 940.

Fixed Facility

Hazardous materials incidents can be broken down into the subcategories of transportation and fixed facility. This section of the report focuses on environmentally hazardous materials at fixed facilities.

In Pennsylvania, facilities that use, manufacture, or store hazardous materials must comply with Title III of the federal Superfund Amendments and Reauthorization Act (SARA), and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. There are twenty-one SARA Title III facilities in Monroe County. These facilities listed as SARA sites should not be considered an exhaustive and comprehensive list of all locations where hazardous materials reside in the county. *Figure 37 – Hazardous Waste Locations* identifies SARA Title III facilities as well as several other locations that consume, store, or release potentially hazardous materials and wastes.

Fixed facilities are also monitored by the Environmental Protection Agency (EPA). The EPA has identified hazardous materials sites, not regulated by SARA Title III, and are known as Toxic Releases Inventory (TRI) sites. Facilities which employ ten or more full time employees, and which manufacture or process more than 25,000 pounds (or use more than 10,000 pounds) of any SARA Section 313-listed toxic chemical in the course of a calendar year are required to report

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

TRI information to the EPA. The EPA is the federal enforcement agency responsible for SARA Title III and PEMA classifications. As of 2024, there are nine TRI facilities in Monroe County.

Oil and gas extraction facilities can also be sources of hazardous material release. There are no active oil and gas wells reported in Monroe County, as of the writing of this plan.

4.3.13.2 Range of Magnitude

Transportation

While often accidental, releases can occur because of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, environmental hazards are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, or hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

Hazardous material release can contaminate air, water, and soil, and can possibly cause injuries, poisonings, or deaths. Hazardous materials fall into nine hazards classes. These hazard classes are as follows:

- Class #1: Explosives
- Class #2: Gases (flammable, non-flammable, non-toxic, and toxic)
- Class #3: Flammable and Combustible Liquids
- Class #4: Flammable Solids (spontaneously combustible and dangerous when wet materials/water reactive substances)
- Class #5: Oxidizing substances and organic peroxides
- Class #6: Toxic Substances and Infectious Substances
- Class #7: Radioactive Materials
- Class #8: Corrosive Substances
- Class #9: Miscellaneous Hazardous Materials / Substances

All nine hazard classes can be found in transportation incidences.

Fixed Facility

All nine hazard classes can be found at fixed facilities. Certain conditions can exacerbate release incidents and these events include fixed facilities:

- Micrometeorological effects of buildings and terrain which alters the dispersion of hazardous materials.
- Proximity to surface water and ground water resources.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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.

The type of material released, distance, and related response time of emergency responders also significantly impact severity and scope of hazardous material releases and clean-up efforts. Areas most proximal to the release are usually at the greatest level of risk, but depending on the material, a release can travel great distances or remain present in the environment for long periods of time (centuries or millennia for some radioactive materials) resulting in chronic and extensive impacts on people and the environment.

Oil and gas well drilling can have a variety of effects on the environment. Abandoned oil and gas wells, not properly plugged can contaminate groundwater and consequently drinking water wells. Surface waters and soil are sometimes polluted by brine, a salty wastewater product of oil and gas well drilling, and from oil spills occurring at the drilling site or from a pipeline breach. A pipeline breach or an accidental dispersal can spoil public drinking water supplies and can be particularly detrimental to vegetation and aquatic animals, making water safety an important factor in oil and gas extraction. In some cases, associated with hydraulic fracturing (fracking), methane has been found contaminating drinking water in surrounding areas.

Natural gas fires occur when natural gas is ignited at the well site. Often, these fires erupt during drilling when a spark from machinery or equipment ignites the gas. The initial explosion and resulting flames have the potential to seriously injure or kill individuals in the immediate area. These fires are often difficult to extinguish due to the intensity of the flame and the abundant fuel source.

4.3.13.3 Past Occurrence

Transportation

In the past, deaths have resulted from a fuel oil truck fire. Monroe County has had various transportation emergency incidents over the past four years that have resulted in multiple deaths and major roadway shutdowns. More recent events are recorded in the WebEOC and county reporting software and are summarized in *Table 57 – Hazardous Material Incidents*.

Transportation accidents that involved hazardous materials were included in the table below.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 57 - Hazardous Material Incidents

Hazardous Material Incidents		
Municipality	Date	Event
Monroe County	06/10/2021	Fuel Spill
Pocono Township	07/17/2021	Propane Gas Leak
Tunkhannock Township	08/09/2021	Ethylene Glycol Release
Paradise Township	08/24/2021	Heating Fuel Spill
Tobyhanna Township	09/27/2021	Fuel Spill
Stroudsburg Borough	10/04/2021	Gas Alarm
Middle Smithfield Township	11/04/2021	Carbon Monoxide w/patient
Stroud Township	11/04/2024	Carbon Monoxide w/patient
Middle Smithfield Township	11/30/2021	MVA Fuel Spill
East Smithfield Township	12/11/2021	Spill
Barrett Township	02/14/2022	Unknown Oil Dumping
Middle Smithfield Township	02/16/2022	Kerosene Spill
Polk Township	03/07/2022	Home Heating Oil Spill
Chestnuthill Township	04/23/2022	Oil Spill
Stroud Township	05/16/2022	Road Closure and Hazardous Materials
Tobyhanna Township	07/03/2022	Poisonous Gas Incident
Ross Township	08/14/2022	Fuel Leak
East Stroudsburg Borough	08/15/2022	HazMat Incident
Mt Pocono Borough	09/23/2022	Oil Truck Fire
Pocono Township	09/25/2022	Diesel Spill
East Stroudsburg Borough	10/06/2022	Natural Gas Line Strike
Smithfield Township	10/22/2022	Home Heating Oil Spill
Mt Pocono Borough	12/16/2022	Gas Leak
Coolbaugh Township	01/02/2023	Propane Leak
East Stroudsburg Borough	01/17/2023	HazMat Item Found in Evidence Locker
Tobyhanna Township	02/11/2023	Chlorine Leak
Hamilton Township	02/13/2023	Diesel Fuel Spill
Tunkhannock Township	04/07/2023	HazMat Incident
Pocono Township	04/15/2023	Chemical Incident
Coolbaugh Township	05/24/2023	Release of Unknown Oil
Pocono Township	06/26/2024	Diesel Spill
Smithfield Township	09/12/2023	Tractor Trailer Accident
Barrett Township	09/25/2023	Oil Spill
Hamilton Township	12/02/2023	HazMat Incident
Smithfield Township	03/18/2024	Fuel Leak
Source: WebEOC, County Reporting System, 2024		

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Hazardous materials can be transported by air, sea, and land (over the road or through pipelines). Transportation accidents along roadways is a regular occurrence and a large number of hazardous materials are transported by roadway every day.

Fixed Facility

There have been a number of hazardous material incidents in Monroe County in the past but few of those events have been related to fixed facilities in the county. More recent events are recorded in WebEOC and county reporting software and are summarized in *Table 57 – Hazardous Material Incidents*.

The EPA tracks the management of hazardous materials in facilities that handle significant amounts of hazardous materials. The nine toxic release inventory (TRI) facilities in Monroe County as of 2024 are summarized in *Table 58 – TRI Facilities*. Production-related waste managed is a collective term to refer to how much of a chemical is recycled, combusted for energy recovery, treated for destruction, or disposed of, or otherwise released on and off site.

Table 58 - TRI Facilities

Toxic Release Inventory Facilities				
Name	Zip Code	Industry Sector	Chemical	Production-related Waste Managed (lbs)
All Weather Insulated Panels	18301	322- Fabricated Metals	Diisocyanates	1
Bestway Of Pennsylvania	18326	321- Wood Products	Arsenic Compounds, Chromium Compounds, Copper Compounds	0
Biospectra Inc.	18360	325- Chemicals	Hydrochloric acid	0
National Electrical Carbon Products Inc.	18301	335- Electrical Equipment	Benzo perylene, Copper, Lead, Naphthalene, Polycyclic aromatic compounds, Sodium hydroxide, Toluene	5,083
Royal Chemical Co.	18301	325- Chemicals	Certain glycol ethers, Chlorine, Diethanolamine, Ethylene glycol, Hydrochloric acid, Lead compounds, Mercury, Methanol, Nitric compounds, Phosphoric acid, Sodium hydroxide, Sodium nitrite, Sulfuric acid, Zinc compounds.	15,340

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Toxic Release Inventory Facilities				
Name	Zip Code	Industry Sector	Chemical	Production-related Waste Managed (lbs)
Sanofi Pasteur Inc.	18370	325- Chemicals	Benzo perylene, Hydrochloric acid, Mercury compounds, Nitrate compounds, Ozone, Phenol, Polycyclic aromatic compounds, Sodium nitrite.	1
U.S. Army Tobyhanna Army Depot	18466	999- Other	Dichloromethane, Ethylene glycol, Hydrochloric acid, Lead, Lead compounds, Methanol, Methyl ethyl ketone, Methyl isobutyl ketone, Nitric acid, Xylene.	16,957
Vertellus DWG, LLC.	18327	325- Chemicals	Acetamide, Acetophenone, Ammonia, Ammonium sulfate, Bromine, Chlorine, Dichloromethane, Formic acid, Hydrochloric acid, Maleic anhydride, Methanol, Methyl ethyl ketone, Methyl isobutyl ketone, Methyl tert-butyl ether, Phosphoric acid, Propylene, Sodium hydroxide, Sulfuric acid, Toluene, Xylene, Zinc compounds, n-Butyl alcohol	13,753
Westrock Converting CO LLC. Stroudsburg Mill	18327	322- Paper	Ammonia, Ammonium sulfate, Chlorine, Ethyl arcylate, Lead, Lead compounds, Sodium hydroxide, Sulfuric acid.	8
Source: EPA, 2024				

4.3.13.4 Future Occurrence

Transportation

While many incidents involving hazardous material releases have occurred in Monroe County in the past, they are generally difficult to predict. The nature of traffic accidents is that there is little to no warning for their occurrence, and they can have disastrous results. An occurrence is largely dependent upon the accidental or intentional actions of a person or group.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Fixed Facility

Hazardous material release incidents are generally difficult to predict, but the presence of such dangerous materials warrants preparation for accidental or intentional release events. Emergency response agencies in Monroe County should be prepared to handle the types of hazardous materials housed and used the SARA Title III facilities, TRI facilities, and oil and gas wells that are located within the county. The Federal Superfund Amendments and Reauthorization Act (SARA) is also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Local Emergency Planning Committees (LEPC) are designed by EPCRA to ensure that state and local communities are prepared to respond to potential chemical accidents.

4.3.13.5 Vulnerability Assessment

Transportation

Quick response to transportation accidents involving hazardous materials minimizes the volume and concentration of hazardous materials that are transported and dispersed through the air, water, and soil. Every municipality within Monroe County is vulnerable to a hazardous materials incident caused along a transportation route. These incidents can occur along highways, railways, and pipelines. *Figure 38 – Environmental Hazard Transportation Vulnerability Map* identified the 2,000-foot hazard corridor for all major highways in Monroe County. *Figure 39 – Annual Truck Traffic Percentages* identifies the annual truck traffic percentages for all of the roadways in Monroe County.

Fixed Facility

Populations, critical infrastructure, and natural habitats within 1.5 miles of SARA Title III and Toxic Release Inventory sites are vulnerable to hazardous material incidents.

Private water suppliers such as domestic drinking water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants, including methane, which can pose a fire and explosive hazard. Ideally, vulnerability of private drinking well owners would be established by comparing the distance of drinking water wells to known oil and gas well locations, but this extensive detailed data is not readily available. Private drinking water is largely unregulated and information on these wells is voluntarily submitted to the Pennsylvania Topographic and Geologic Survey by water well drillers, and the existing data is largely incomplete and/or not completely accurate. Monroe County does not have any oil and gas wells as of 2024. *Table 59 – Oil and Gas Wells & Drinking Water Wells* illustrates the type of well and the local domestic drinking water wells for each municipality.

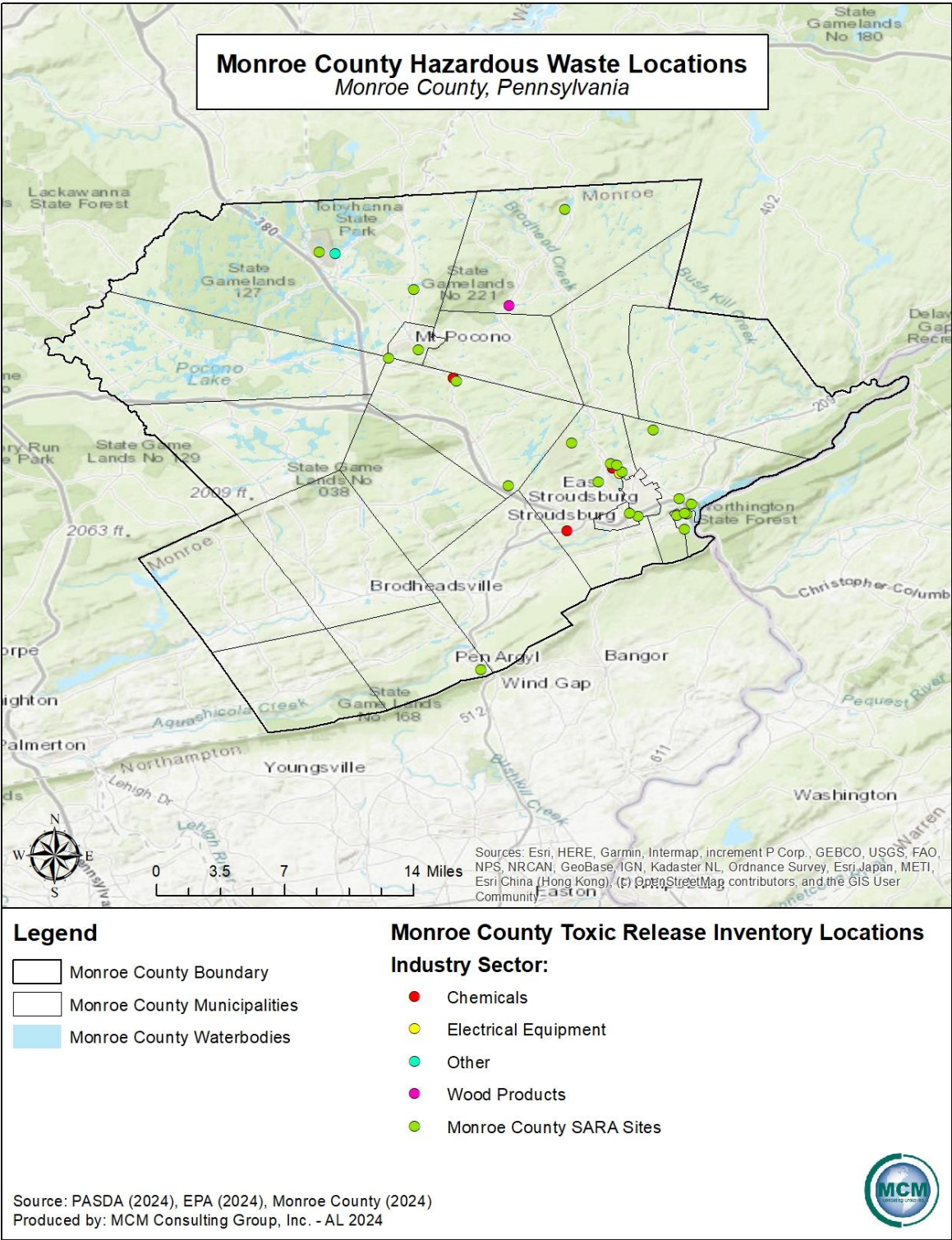
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 59 - Oil and Gas Wells & Drinking Water Wells

Oil & Gas Wells in Monroe County (2024)					
Municipality	Type of Well				Domestic Water Wells
	Active	Abandoned	Inactive	Proposed	
Barrett Township	0	0	0	0	416
Chestnuthill Township	0	0	0	0	2,551
Coolbaugh Township	0	0	0	0	1,549
Delaware Water Gap Borough	0	0	0	0	13
East Stroudsburg Borough	0	0	0	0	12
Eldred Township	0	0	0	0	405
Hamilton Township	0	0	0	0	904
Jackson Township	0	0	0	0	792
Middle Smithfield Township	0	0	0	0	1791
Mount Pocono Borough	0	0	0	0	26
Paradise Township	0	0	0	0	516
Pocono Township	0	0	0	0	1,968
Polk Township	0	0	0	0	873
Price Township	0	0	0	0	812
Ross Township	0	0	0	0	654
Smithfield Township	0	0	0	0	713
Stroud Township	0	0	0	0	699
Stroudsburg Borough	0	0	0	0	7
Tobyhanna Township	0	0	0	0	3,666
Tunkhannock Township	0	0	0	0	1,871
Total:	0	0	0	0	20,238
Source: PA DEP, PA GEOCODE, 2025 (Countywide data less municipalities not in Monroe County)					

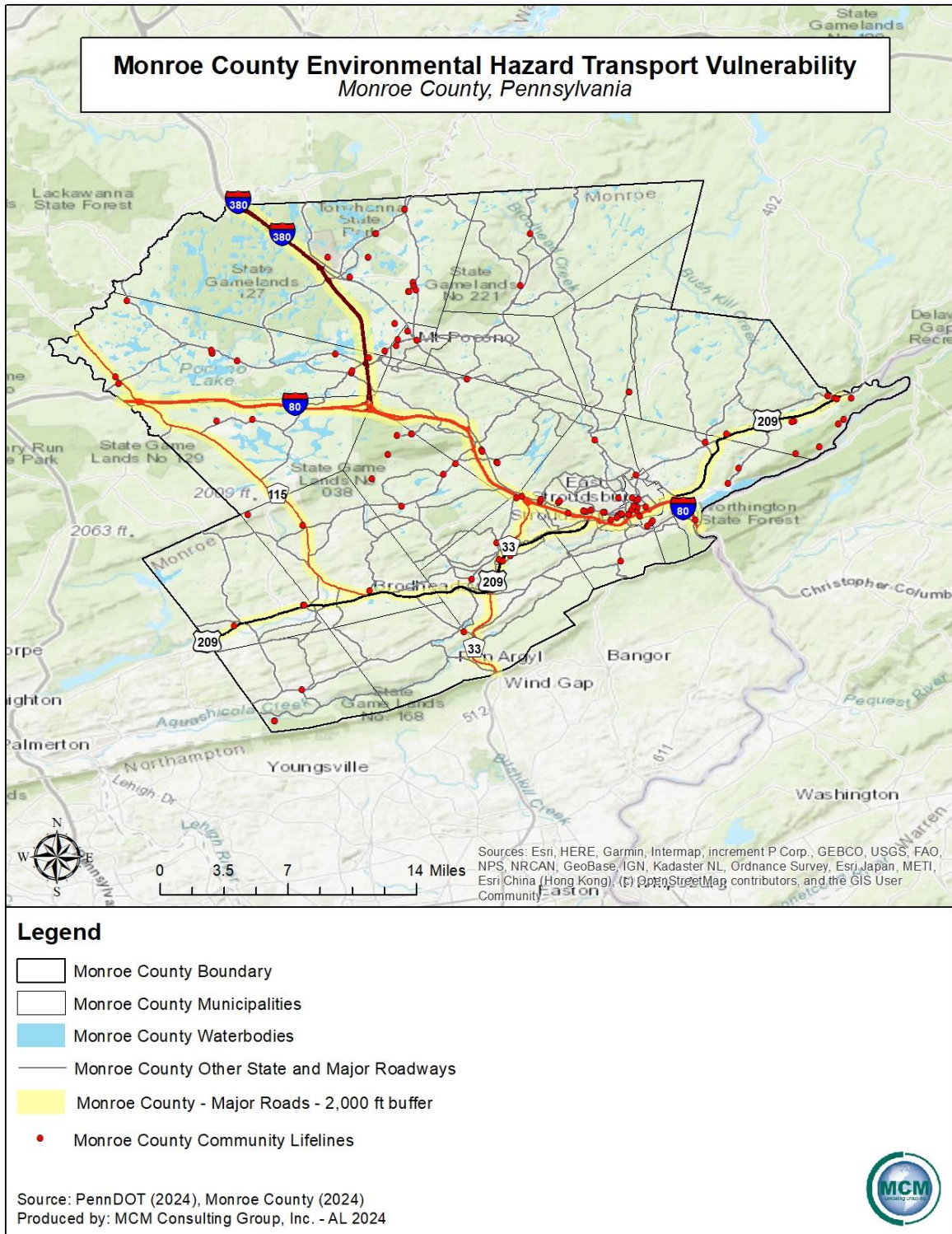
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Figure 37 - Hazardous Waste Locations



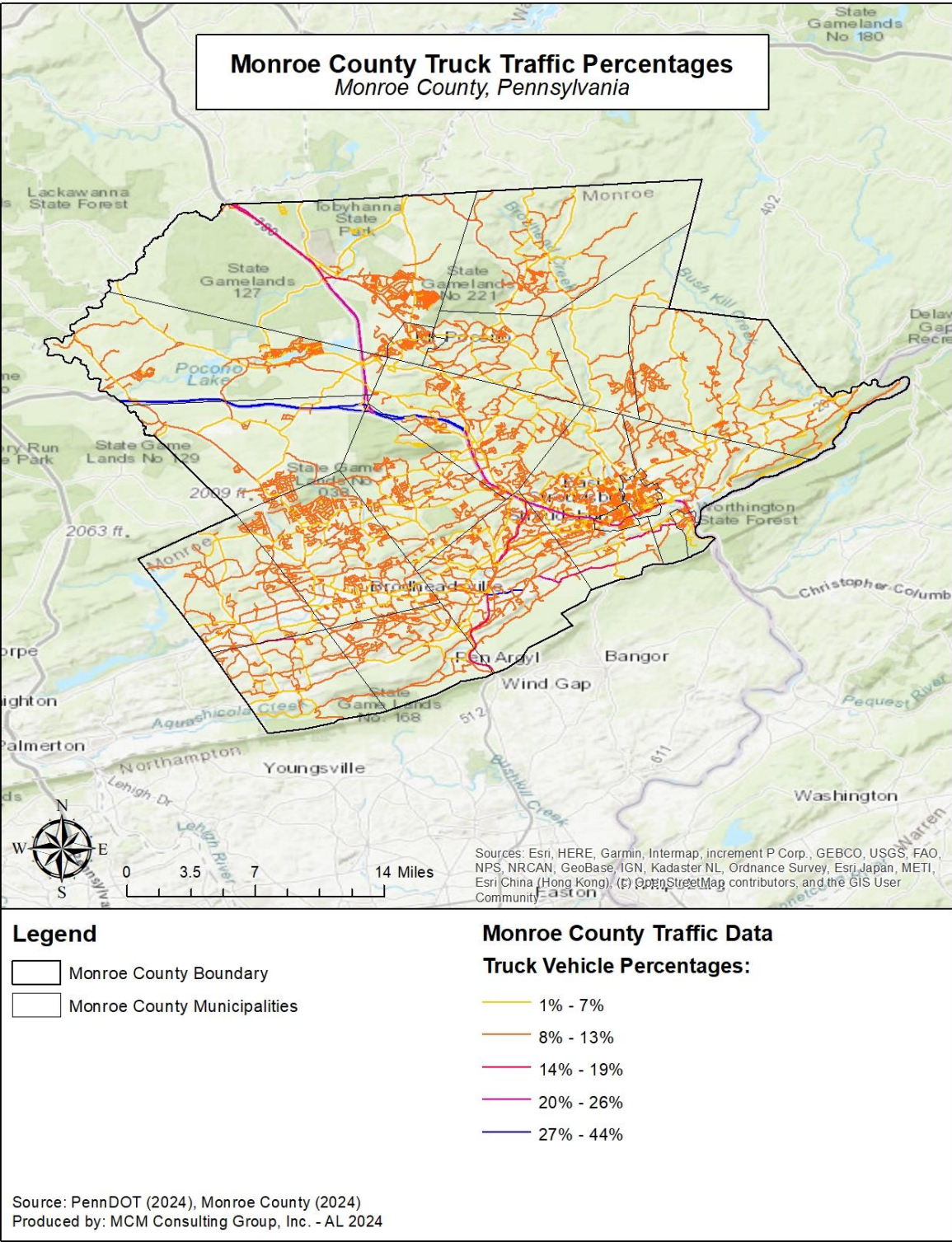
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 38 - Environmental Hazard Transportation Vulnerability



Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

Figure 39 - Annual Truck Traffic Percentages



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.14. Nuclear Incidents

4.3.14.1 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
- 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
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.)

Two of the nuclear power stations are within 50 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 41 – Monroe County Municipalities in the 50-Mile Ingestion Exposure Pathways*.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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.

4.3.14.2 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 60 - 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 60 - 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 received 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:

1. 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.
2. 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).
3. 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.
4. 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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.

4.3.14.3 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,

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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, Pennsylvania 2025 Hazard Mitigation Plan

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.

4.3.14.4 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 near 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.

4.3.14.5 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 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 \$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

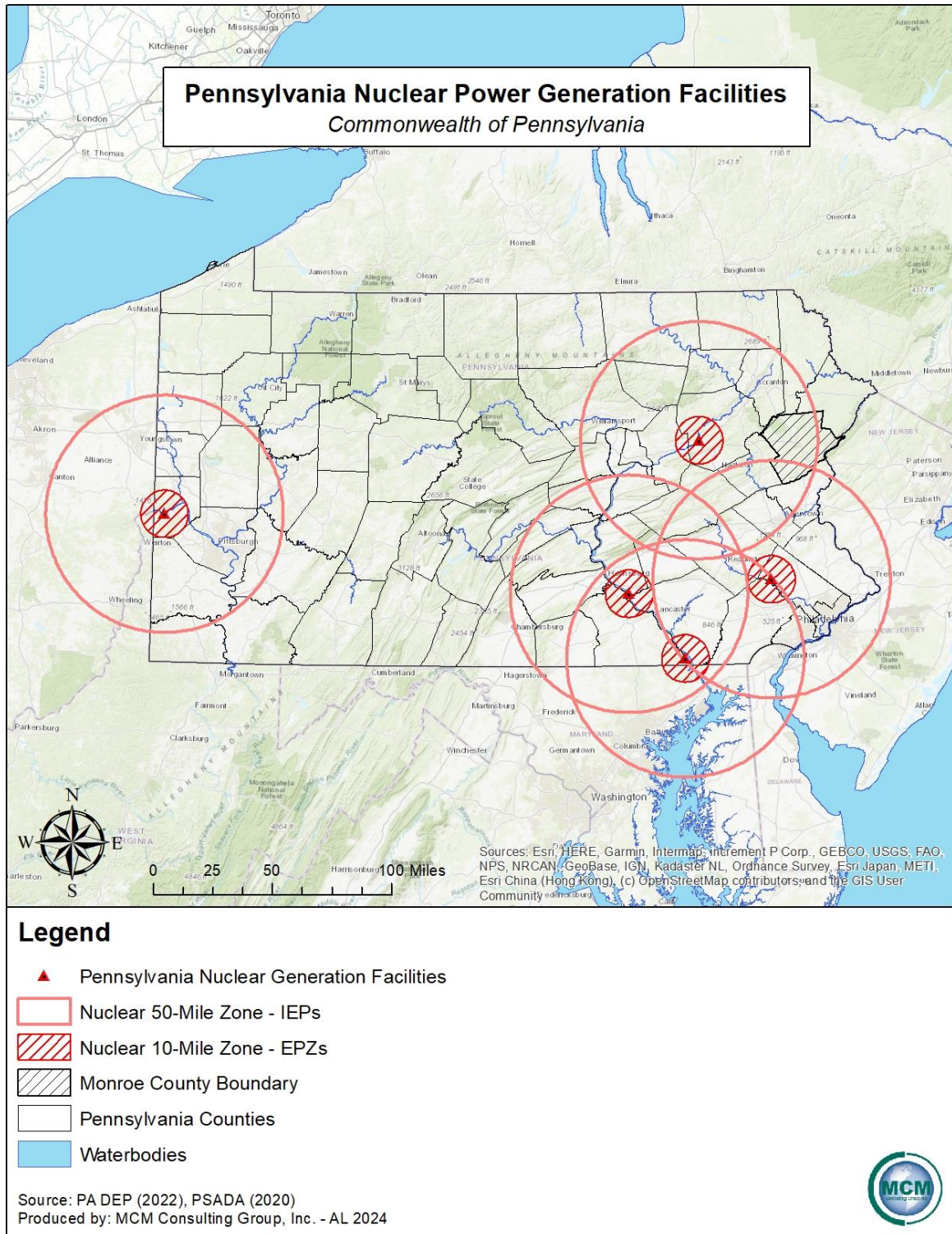
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Joint Water Authority, Brodhead Creek Regional Authority, East Stroudsburg Borough Water, 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 40 - Pennsylvania Nuclear Power Stations



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.15. Substance Use Disorder

4.3.15.1 Location and Extent

Substance Use Disorder (SUD) is a chronic condition characterized by compulsive drug or alcohol use despite the harmful consequences. According to the American Addiction Centers substance use disorder affects brain function and behavior, leading to an inability to control substance intake (Fuller 2023). Symptoms include intense cravings, tolerance, withdrawal symptoms, and continued use despite negative effects on health, relationships, and responsibilities. Substance use disorder can impact anyone regardless of age, gender, or background, and often requires comprehensive treatment involving therapy, medication, and support to achieve recovery.

Substance use disorder escalates into opioid addiction through a progression that often starts with the legitimate medical use of prescription opioids for pain relief. Over time, individuals may develop a tolerance, requiring larger doses for the same effect. This can evolve into physical dependence, where the body experiences withdrawal symptoms without the drug. Psychological factors, such as seeking relief from stress, trauma, or co-occurring mental health disorders, may compel individuals to continue using opioids despite negative consequences. Eventually, the compulsive need to use opioids takes over, characterized by addiction, where obtaining and using the drug becomes a central focus of life.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) ten classes of substance use disorder exist. These substances use related mental illnesses are alcohol use disorder, cannabis use disorder, phencyclidine use disorder, other hallucinogen use disorder that differ from phencyclidine, inhalant use disorder, opioid use disorder, sedative, hypnotic or anxiolytic use disorder and lastly stimulant use disorder which accompanies cocaine or methamphetamine.

Pennsylvania and the United States at large have been experiencing a substance use disorder epidemic which can lead to opioid drug abuse. According to the Pennsylvania Department of Health, the opioid overdose epidemic is the worst public health crisis in Pennsylvania. It affects Pennsylvanians across the state, from big cities to rural communities. Substance use disorder and opioid addiction have increased over the last few years due to the hardships faced from the COVID-19 pandemic.

Opioids, mainly synthetic opioids (other than methadone), are currently the main driver of drug overdose deaths. According to the Center for Disease Control and Prevention (CDC), 72.9% of opioid-involved overdose deaths involved synthetic opioids. Opioid addiction occurs when an

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

individual becomes physically dependent on opioids. Opioids are a class of drug that reduces pain by interacting 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 occur 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.

Opioids are highly addictive. They block the body's ability to feel pain and can create a sense of euphoria. Additionally, individuals often build a tolerance to opioids, which can lead to misuse and overdose.

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 substance use disorder epidemic. The opioid crisis along with substance use disorder 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.15.2 Range of Magnitude

Substance use disorder may lead to a narcotic addiction, which could lead to an overdose and can sometimes be fatal. The most dangerous side effect of an overdose can include depressed breathing. Lack of oxygen to the brain causes permanent brain damage, leading to organ failure, and eventually death. Signs and symptoms include respiratory depression, drowsiness, disorientation, pinpoint pupils, and clammy skin. Substance use dependency 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 annual estimate of 22,000 babies born in the United States with this condition.

4.3.15.3 Past Occurrence

In 2023, there was an estimated total of 105,384 drug-related overdose deaths in the United States. This is the second highest number of overdose deaths ever recorded in a 12-month period, according to the recent provisional data from the CDC. *Table 61– Drug Overdose Mortality In Monroe County* shows death rates and deaths per year in Monroe County from 2018 to 2023. According to the Monroe County Control Center, as of October 2024 they received 212, 911 calls regarding overdoses. It is important to note that the number of deaths by overdose was not provided at the time of writing this report. The most common age group for opioid abuse in Monroe County is the 40-49 years of age demographic. In Monroe County, the overdose rate of males is greater than the overdose rate of females. Whites have the highest total rate of overdose deaths in Monroe County, while Blacks have the highest per capita rate of overdose deaths when adjusted for population size. The most used opioids in Monroe County are fentanyl, heroin, cocaine, benzodiazepines, and prescribed opioids. Data sets for 2025 were not available at the time of writing this plan.

Table 61 - Drug Overdose Mortality In Monroe County

Drug Overdose Mortality in Monroe County	
Year	Deaths Per Year
2018	55
2019	58
2020	86
2021	68
2022	55
2023	57

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 62 - Drugs Present in 2020 Pennsylvania Overdose Deaths

Drugs Present in 2020 PA Overdose Deaths	
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%
Source: DEA, 2020	

4.3.15.4 Future Occurrence

Both Monroe County and Pennsylvania have seen a steady rise in substance use disorder and the use of opioids over the last several years, with drug-related death rates increasing at a high percentage. Substance use disorder is a pressing issue in Pennsylvania, with far-reaching implications for public health, safety, and the well-being of individuals. Future occurrences of substance use, and opioid addiction are unclear as the state moves forward with overdose prevention initiatives using Naloxone, alternative pain treatments, improvement of tools for families and first responders, and expansion of treatment access. The Pennsylvania government has taken various approaches to help with the prevention of mass future occurrences across the Commonwealth. To help prevent future drug abuse and protect individual health among communities in Pennsylvania, Pennsylvania's Prescription Drug Monitoring Program (PA DMP) collects information on all filled prescriptions for controlled substances. This information helps health care providers safely prescribe controlled substances and helps patients get correct treatment. The PA DMP also has drug take-back boxes located in the counties for an easy, convenient location where anyone can dispose of their unused, expired, or unwanted prescriptions to help lower potential drug overuse. In Monroe County, there are three drug take-back boxes located throughout the county. The drug take-back box locations include Monroe County Sheriff-Monroe County House, Pennsylvania State Police the Stroudsburg Barracks, the Stroud Area Regional Police Lobby, and the Pocono Township Police Lobby.

In the event of an opioid overdose, death can sometimes be prevented with the use of the drug naloxone. The former Pennsylvania Secretary of Health, Dr. Rachel Levine, in 2020, signed

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

updated standing order prescriptions of naloxone. Naloxone is a medication that can reverse an overdose that is caused by an opioid drug (i.e., prescription pain medication or heroin). Naloxone is used to block the effects of opioids and is sold under the brand name Narcan. When administered during an overdose, naloxone blocks the effects of opioids on the brain and restores breathing within two to eight minutes. Naloxone has been used safely by medical professionals for more than forty years and its only function is to reverse the effects of opioids on the brain and respiratory system to prevent death. Also, with the January 10, 2018, disaster declaration, emergency medical technicians (EMTs) are now allowed to leave naloxone behind at a scene of a recent overdose further increasing the distribution and accessibility of lifesaving medication. According to a study published in September 2018, drug users reported that users often have multiple overdoses during their drug use, and the 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. Naloxone is another way to reduce future occurrences of the opioid epidemic from occurring in Monroe County. According to the National Library of Medicines, supervised injection sites can provide disordered substance users with a secure location to reduce the risk of overdose, while also weaning them off addictive substances.

Opioid drugs have been a problematic and addictive method 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.

4.3.15.5 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. Substance use disorder is a direct detriment to the personal wellbeing of addicts, a burden to their families and communities, and a strain on the emergency response system that cares for overdose victims. In general, jurisdictions that are more densely populated are more vulnerable to opioid addiction threats as access to the drugs increases. However, rural communities in general experience larger per-capita opioid-related deaths. Jurisdictional losses in the opioid addiction crisis stem from lost wages, productivity, and resources rather than losses to buildings or land. Many counties across the Commonwealth,

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

including Monroe County, have seen an increase of time and resources devoted to the opioid epidemic as overdose and response increase.

While Substance use disorder and opioid addiction is often viewed as a criminal problem, it can also be viewed 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.

According to the National Institute of Mental Health, substance use disorder often stems from underlying mental health issues such as depression, anxiety, trauma, or unresolved psychological struggles. Individuals may turn to substances as a coping mechanism to alleviate emotional pain or distress. However, prolonged substance abuse can exacerbate mental health symptoms and lead to a vicious cycle of dependency. Additionally, genetic predispositions and environmental factors can also contribute to the development of both substances use disorders and mental health disorders (National Institute of Mental Health, 2023).

The vulnerability in the county depends on the number of additional risk factors on the vulnerable population such as genetic, psychological, and environmental factors that play a role in addiction. The known risk factors of opioid misuse and addiction include poverty, unemployment, family and/or personal history of substance abuse, history of criminal activity, history of severe depression or anxiety, and prior drug/alcohol rehabilitation. In addition, women have a unique set of risk factors for opioid addiction. Women are more likely than men to have diagnosed chronic pain. Compared with men, women are also more likely to be prescribed opioid medications, to be given higher doses, and to use opioids for longer periods of time. Women may also have biological tendencies to become dependent on prescription pain relievers more quickly than men. Therefore, if the county were to have a population with a great amount of these risk factors, the county would be very vulnerable to the opioid epidemic.

The COVID-19 pandemic and its periods of quarantine caused vulnerability in opioid users throughout Monroe County. It is likely that the emergence of COVID-19 and subsequent disruptions in health care and social safety nets combined with social and economic stressors has fueled the opioid epidemic. The COVID-19 pandemic challenged vulnerable populations, including those with opioid use disorders. The opioid epidemic and COVID-19 pandemic intersected and presented unprecedented challenges for families and communities. Opioid use affects respiratory and pulmonary health, which may make those with opioid use disorders more susceptible to COVID-19. In addition, chronic respiratory disease is already known to increase overdose mortality risk among people taking opioids, and decreased lung capacity from COVID-

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

19 could lead to similar health effects. Secondary impacts from the COVID-19 pandemic included disruption of treatment and recovery services, limited access to mental health services and peer support, disrupted routines, loss of work, and increased stress, which led to increased opioid use and risk of relapse for those in recovery. Additionally, the pandemic took away the attention from the media, from legislators, and from public health agencies that was being focused on the opioid crisis. The opioid epidemic in Pennsylvania increased 63% since the end of the pandemic.

Risk factors may arise from indirect factors including housing instability and incarceration. Those with substance use disorder and opioid use disorders are potentially at a higher risk for housing insecurity, homelessness, and incarceration. Congregate living facilities, such as homeless shelters, jails, and prisons are high-risk environments for virus transmission, and there are challenges in implementing recommendations from the CDC, such as social distancing and quarantine.

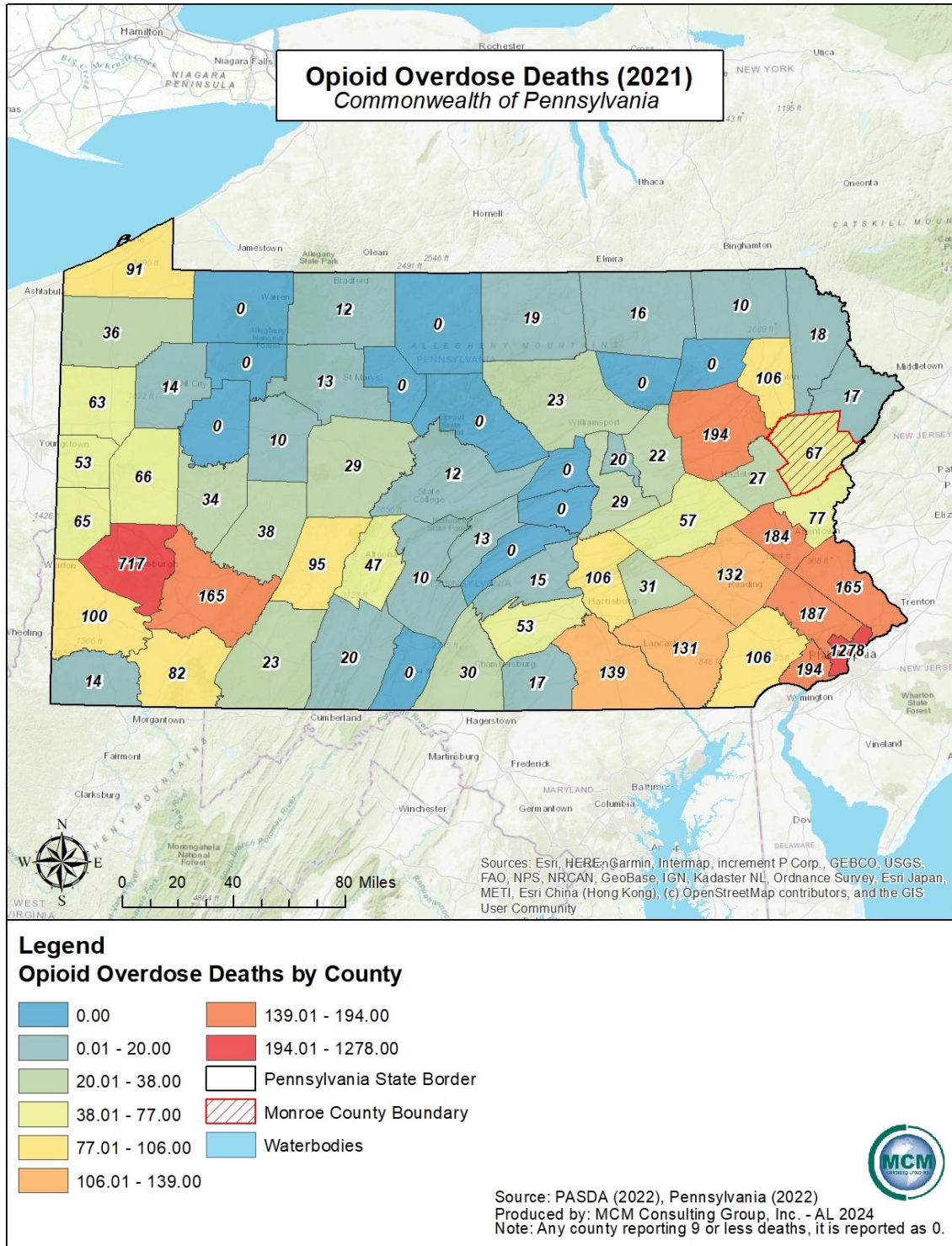
Additionally, first responders and medical personnel are also a vulnerable population when dealing with the substance use disorder and opioid epidemic. First responders face exposure risk due to an increase in emergency calls due to an increase in the crisis, particularly to synthetic fentanyl. Fentanyl and related substances are hazardous materials, which cause the environment and the people around the substance to be vulnerable. Unintentionally, fentanyl contact can impact first responders and others that are in close proximity to the opioid user. Depending on the potency of the drug, it can take as little as a few milligrams of fentanyl to cause fatal health complications, the equivalent of a few grains of sand. There have been several reports nationally of first responders accidentally overdosing on fentanyl through brief skin contact or the drug becoming airborne. It is best for first responders to remain wary 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 excreted human urine and feces, or improper disposal of medications. 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. A worst-case scenario with substance uses in Monroe County would be a high number of overdoses among residents and insufficient first responder personnel and material resources.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 42 – Opioid Overdose Deaths in Pennsylvania 2021 and Figure 43 – Opioid Overdose Deaths in Pennsylvania 2022 illustrate the number of deaths per county in the Commonwealth of Pennsylvania.

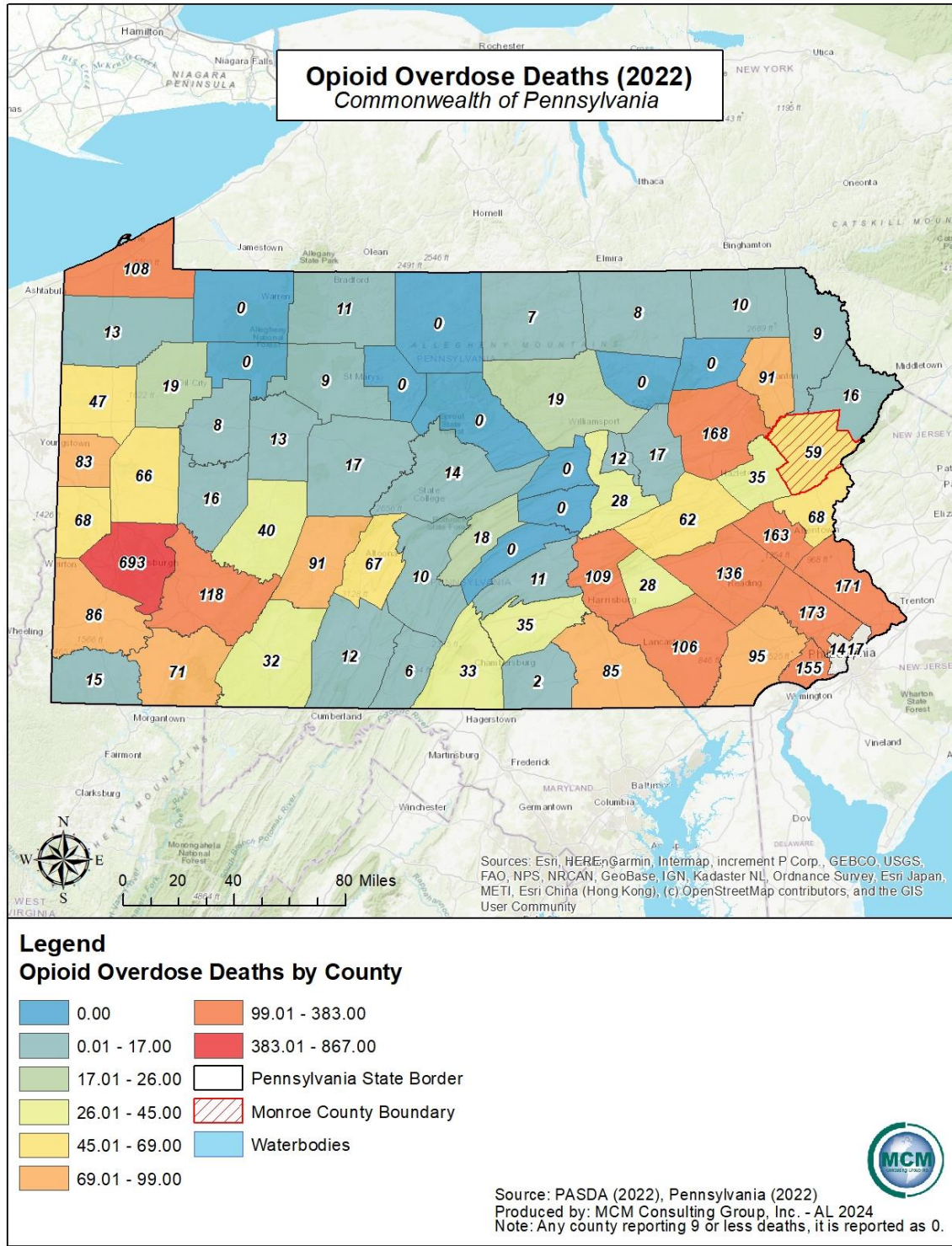
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 42 - Opioid Overdose Deaths in Pennsylvania 2021



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 43 - Opioid Overdose Deaths in Pennsylvania 2022



Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.16. Terrorism/Cyberterrorism

4.3.16.1 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 (HVEs) 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 HVEs as “the primary terrorist threat to the homeland here today, without question.”

Community lifeline facilities are either in the public or private sector that provide essential products and/or services to the general public. Community lifeline 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. Community lifeline 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

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

any major highway and marginalized groups such as LGBTQ persons and racial, religious, or other 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
- Cultural sites
- Government facilities

4.3.16.2 Range of Magnitude

Terrorism may include use of Weapons of Mass Destruction (WMD) (including chemical, biological, radiological, nuclear, and explosive 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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 use taxpayer assets by deploying police, EMS and/or fire units. Monroe County has four school districts (public schools K through 12th grade) that include twenty-nine primary, secondary, and high schools. There are two post-secondary schools located in Monroe County, East Stroudsburg University and Northampton Community College.

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 cyber terrorism threat to institutions 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.

4.3.16.3 Past Occurrence

No major terrorism or cyber terrorism events have occurred in Monroe County, Pennsylvania. Cyber terrorism events are becoming more common in areas of local government, and these include counties near Monroe County, PA.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 person or via the internet, and who may struggle with mental health issues. Hate groups such as the Ku Klux Klan (KKK), Aryan Nation, the New Black Panther Party, and more recently, the Alt-Right, Antifa, anarcho-communists, Proud Boys, plus conspiracy theorist believers/promoters such as QAnon, have been part of domestic terrorism in different forms. During the May 2020 George Floyd protests, anti-police individuals associated with one or more of the groups created incendiary devices to burn down the Minneapolis Third Precinct. On January 6, 2021, individuals associated with one or more of the groups, stormed the United States Capitol to disrupt the certification of the 2020 presidential election, resulting in five deaths and evacuation of Congress.

Active Shooters

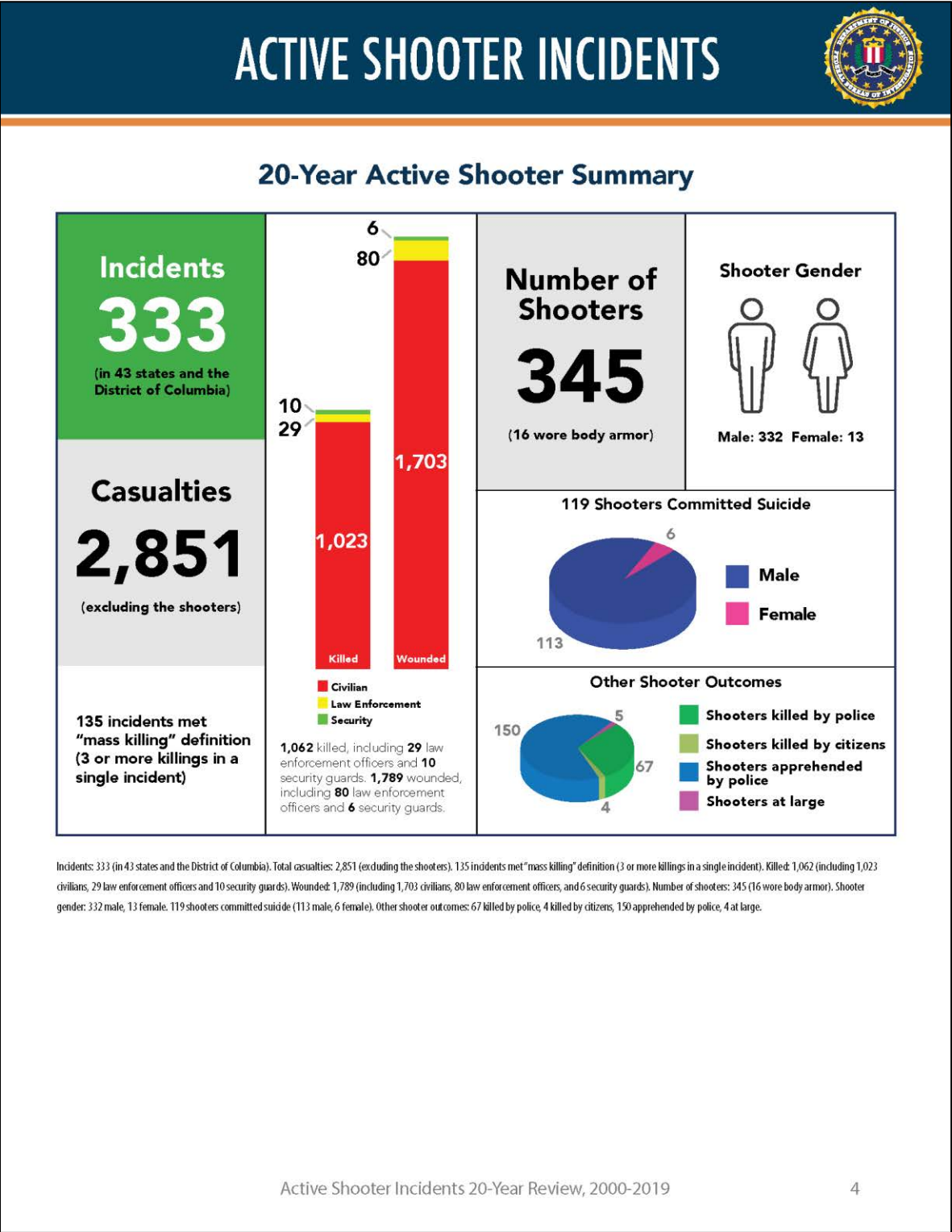
An active assailant (shooter), as defined by the U.S. Department of Homeland Security, is an individual actively engaged in killing or attempting to kill people in a confined area, in most cases, active shooters use firearms and there is not necessarily a pattern or method to their selection of victims. Throughout the year in 2023, there were a total of at least 656 mass shooting incidents in the United States according to the Gun Violence Archive. Often these shooters are HVEs. Two significant events have occurred in Pennsylvania in recent history: one occurred on October 27, 2018, when 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. One of the most tragic recent active shooters occurred in Uvalde, Texas, where an armored and masked gunman entered the Robb Elementary School on May 24, 2022 and killed nineteen students and two teachers. Another active shooter event occurred on November 22, 2022 when an employee at a Walmart in Chesapeake, Virginia entered the breakroom of the Chesapeake Walmart and killed six individuals before taking his own life.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Other active shooter events in the United States in recent years include Virginia Tech (April 2007), Sandy Hook Elementary School (December 2012), San Bernardino, California (December 2015), an Aurora, Colorado movie theater (July 2012) a church in Charleston, South Carolina (June 2015). An *Active Shooter Incidents 20-Year Review* by the FBI concluded that there has been a significant recent increase in frequency of active shooter incidents, and that most shooters were male. The report documents data from all the incidents, including location, commercial environments, educational environments, open spaces, military and other government properties, residential locations, houses of worship, and health care facilities (FBI, 2021). *Figure 44 – Active Shooter Incidents – 20 Year Active Shooter Summary* is one page from the report that illustrates a numerical breakdown of shooting events for those twenty years. *Figure 45 – Education Environments* shows two more summary pages from the report that detail active shooter statistics in educational environments.

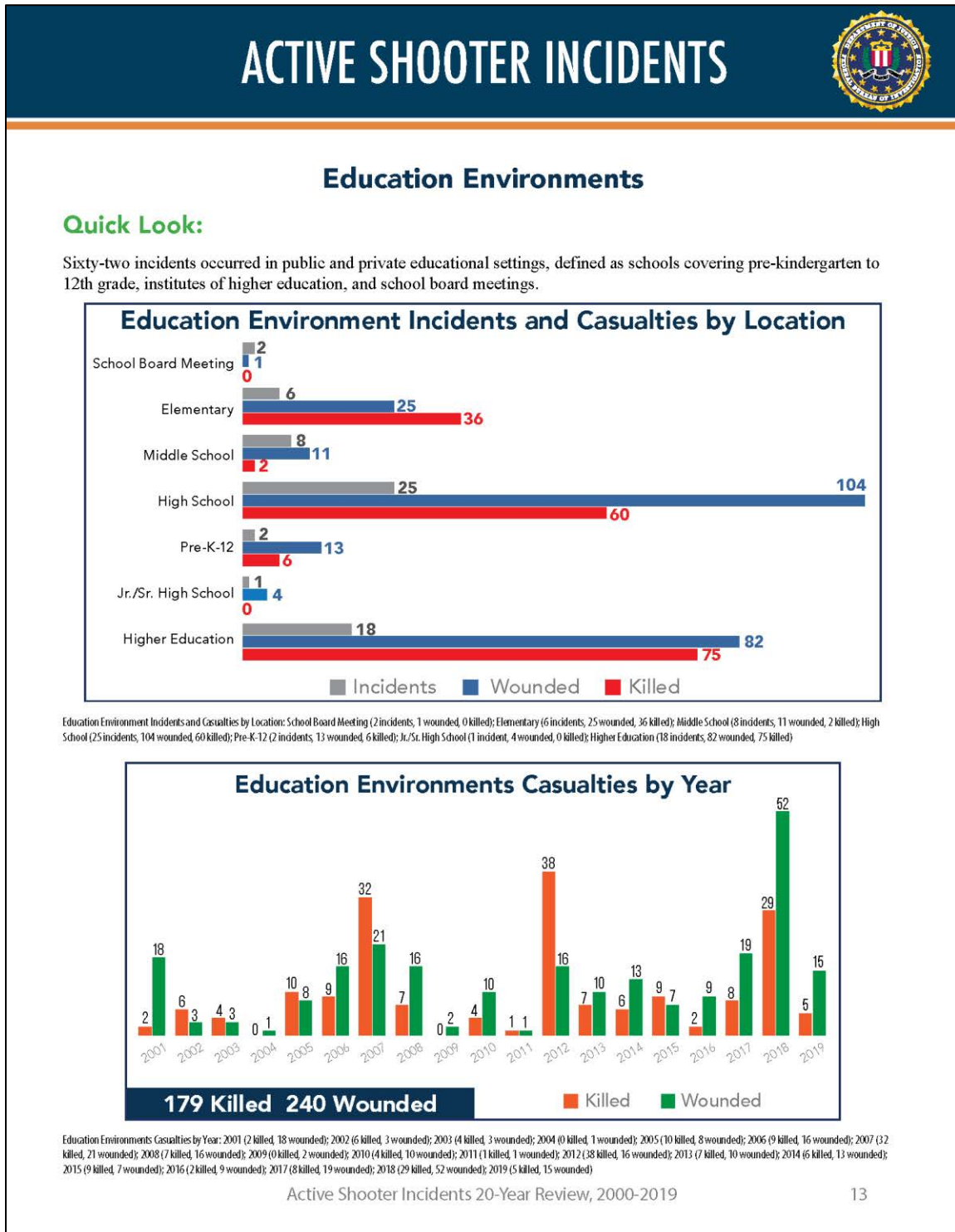
Monroe County, Pennsylvania
2025 Hazard Mitigation Plan

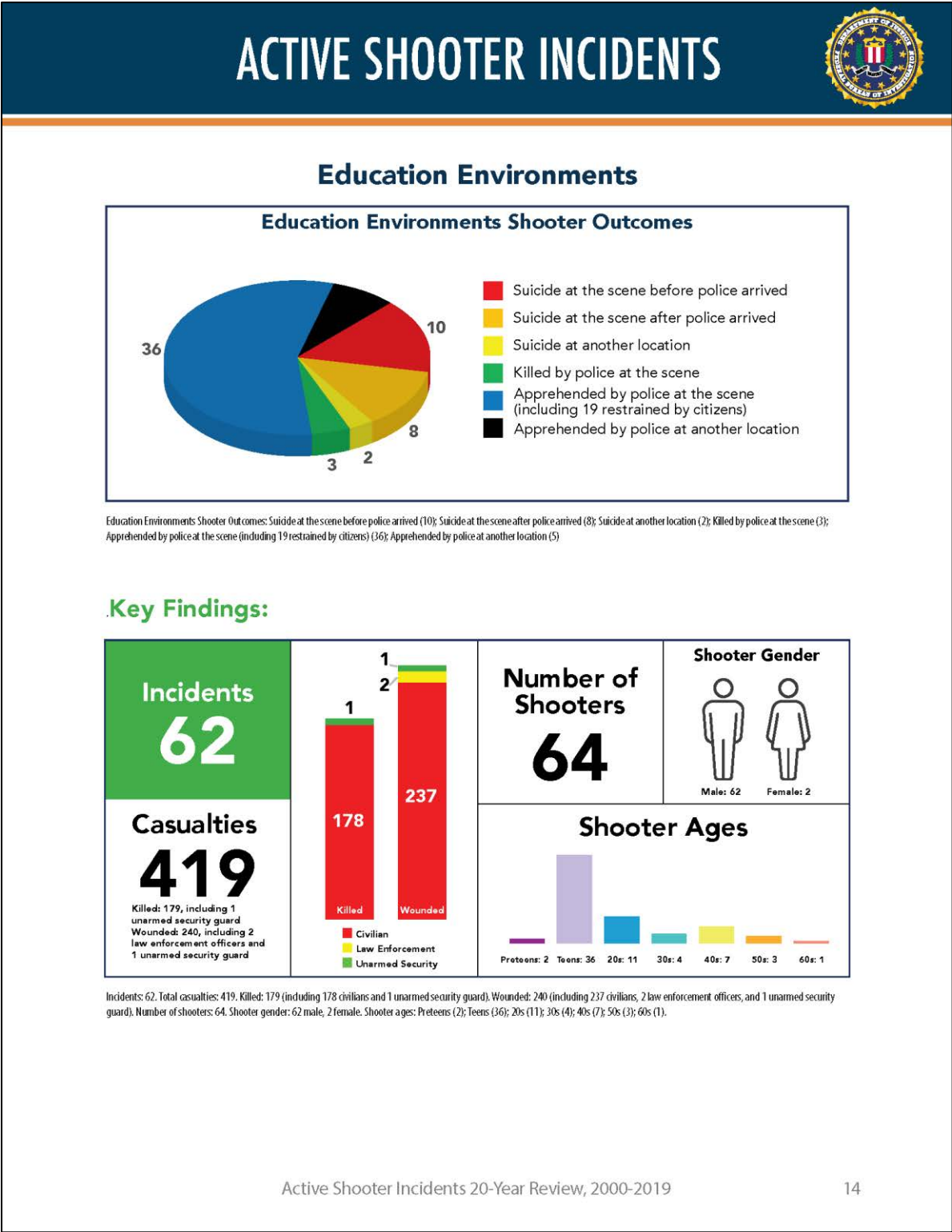
Figure 44 - Active Shooter Incidents - 20 Year Active Shooter Summary



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 45 - Education Environments





Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

The complete report may be found here: <https://www.fbi.gov/file-repository/active-shooter-incidents-20-year-review-2000-2019-060121.pdf/view>.

Cyber-Threats

While Monroe County has not been the target of any critical cyber terrorist events, the county has seen multiple security breaches due to online phishing and other scams.

One hack attack took down the largest fuel pipeline in the U.S. and led to massive gasoline shortages; it was the result of a single compromised password. Hackers gained entry into the networks of Colonial Pipeline Company on April 29, 2021 through a virtual private network account, which allowed employees to remotely access the company's computer network. On May 7, 2021, a ransom of \$4.4 million was demanded by the hackers, causing Colonial to shut down the entire supply line, immediately prompting temporary gasoline shortages and panic buying up and down the East Coast. The hackers, who were an affiliate of a Russian-linked cybercrime group known as *DarkSide*, were paid the ransom. The hackers also stole nearly 100 gigabytes of data from Colonial Pipeline and threatened to leak it if the ransom was not paid, according to Bloomberg News.

Then, in early June 2021, JBS, the world's largest meat company by sales, paid an \$11 million ransom to cybercriminals who temporarily knocked out plants that process roughly one-fifth of the nation's meat supply. The ransom payment, in bitcoin, was made to shield JBS meat plants from further disruption and to limit the potential impact on restaurants, grocery stores and farmers that rely on JBS, according to the company.

The attack on JBS was part of a wave of incursions using ransomware, in which companies are hit with demands for multimillion-dollar payments to regain control of their operating systems. The attacks show how hackers have shifted from targeting data-rich companies such as retailers, banks and insurers to essential-service providers such as hospitals, transport operators and food companies.

4.3.16.4 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-nine public schools. Several private schools and colleges/universities are also located in Monroe

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

County. These locations are considered soft targets and may be vulnerable, especially to domestic incidents.

4.3.16.5 Vulnerability Assessment

Monroe County should stay prepared for terroristic events. 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 of 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 to be 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.

Acronis, a global technology company that develops on-premises and cloud software for backup, disaster recovery, and secure file sync and share and data access, issues an annual threat scape report on cybercrime. Entitled *The Acronis Cyberthreats Report*, it 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, Acronis warns aggressive cybercrime activities will continue 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

4.3.17. Transportation Accidents

4.3.17.1 Location and Extent

Transportation accidents are defined as accidents involving highway, air, and rail travel. These incidents are collectively the costliest of all hazards in the Commonwealth in terms of lives lost, injuries, and economic losses. The sheer amount of roadway, coupled with the high volume of traffic, creates the potential for serious accidents along the roads and bridges. In Monroe County there are 367 state-maintained bridges and 68 locally maintained bridges, according to PennDOT. Major transportation routes in Monroe County include Interstate 80, US Route 209, PA State Route 33, and PA State Route 611. Other state routes are also present in the county including PA State Route 115, 314, 423, 447, and 715. *Figure 46 – Major Transportation Routes* shows the major transportation systems in Monroe County.

Monroe County has three public airports; Pocono Mountains Municipal, Flying Dollar, and Rocky Hill Ultralight Airport. Flying Dollar Airport and Rocky Hill Ultralight Airport have turf runways while Pocono Mountains Municipal Airport has paved runways. There exists a potential extent for air transportation accidents to occur due to the number of commercial air traffic that flyovers the county every day. However, a five-mile radius around each airport can be considered a high-risk area since most aviation incidents occur near take-off and landing sites. *Figure 47 – Airports and Vulnerability Zones.*

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 (PNERRA) 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 New York City. According to PNERRA, this is a federal “New Starts” restoration project, and the first phase of the project is currently underway with track being laid on the first seven miles. The next phase of the project will entail laying the 21 miles of rail in New Jersey to connect to the Pennsylvania Northeast Regional Railroad Authority.

- Derailment – an accident on a railway in which a train leaves the rails
- Collision – an accident in which a train strikes something such as another train or highway motor vehicle
- Other – accidents caused by other circumstances like obstructions on rails, fire, or explosion

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Rail transportation is divided into two major categories: freight and passenger. Each category can be subdivided according to carrier type: major carrier and local/regional carriers. Rail accidents can occur anywhere along the miles of rail located in Monroe County.

There are no oil and gas wells located in Monroe County. Pipeline infrastructure is seen throughout the county. There are two major pipeline companies that transport hazardous materials in and through Monroe County. Of these major pipelines, one is for natural gas only; and the other is for natural gas and hydrogen sulfide. *Figure 49 – Utility Pipelines Vulnerability* shows the various pipelines that run through Monroe County.

4.3.17.2 Range of Magnitude

Significant passenger vehicle, air, and rail transportation accidents can result in a wide range of outcomes from damage solely to property to serious injury or even death. The majority of motor vehicle crashes in Pennsylvania are non-fatal, but PennDOT estimates that every hour nine people are injured in a car crash, and every seven hours someone dies as a result of a car crash. Most fatal crashes occur in May and June, but the highest number of crashes overall occur in October, November, and December. Inclement weather and higher traffic volumes and speeds increase the risk for automobile accidents.

Railway and roadway accidents have the potential to result in hazardous materials release. Railroad accidents occur with less frequency than highway accidents. However, when these types of incidents occur, they often cause extensive property damage and have the potential to cause serious injuries or deaths.

The worst-case scenario for a transportation accident impacting the county would be a road or rail accident which results in a hazardous material spill in Stroudsburg Borough, which is the county seat and home to many. Such an event would constitute an immediate health hazard to the population and require evacuation.

4.3.17.3 Past Occurrence

Table 63 – PennDOT Crash Report for Monroe County shows crash statistics recorded by the Pennsylvania Department of Transportation between 2010 and 2022. Reports for 2024 were not available at the time of this report. The year 2016 had the most total crashes in Monroe County while 2020 had the fewest total crashes. The number of total crashes declined over the span of four years between 2016 and 2020 in the county, with 2,621 accidents occurring in 2016 and 1,977 accidents occurring in 2020. Monroe County saw an increase in accidents in 2021 and 2022 with 2,158 accidents occurring in 2021 and 2,232 accidents occurring in 2022. At the time of writing this report, 2023 data was not available. When it becomes available, the 2023 data will

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

determine if Monroe County continues to experience an overall upward trend in traffic accident occurrence.

Most municipalities noted, on the municipality hazard identification and risk evaluation worksheet, that there has been no change in transportation accident frequency or impact. While a majority noted no change, there were a few municipalities that indicated an increase in transportation accidents frequency and impact. Those that indicated an increase contributed to an increase in local traffic through the borough and townships due to it being a tourist area. Alternatively, another cause may include roadwork on major transportation routes, detouring travelers through the local municipalities.

Table 63 - PennDOT Crash Report for Monroe County

PennDOT Crash Report for Monroe County								
Year	Vehicle accidents for Monroe County				Vehicle Accident Deaths for Monroe County			Train/Trolley with Motor Vehicle Crashes/ Fatalities
	Total	Fatal Accidents	Injury Crashes	Property Damage Only	Total Vehicle Accident Fatalities	Alcohol-Related Fatalities	Pedestrian Fatalities	
2010	2,439	33	1,152	1,254	35	12	5	0
2011	2,375	32	1,087	1,256	33	11	4	0
2012	2,256	26	1,059	1,171	27	9	1	0
2013	2,269	24	1,020	1,225	25	8	0	0
2014	2,163	18	981	1,164	23	8	1	0
2015	2,504	32	1,059	1,413	34	6	4	0
2016	2,621	21	1,126	1,474	29	11	1	0
2017	2,456	17	989	1,450	18	5	4	0
2018	2,461	18	1,044	1,399	21	7	3	0
2019	2,393	16	16	1,383	17	3	1	0
2020	1,977	11	847	1,119	11	4	0	0
2021	2,158	25	884	1,249	27	6	3	0
2022	2,232	20	864	1,348	23	9	0	0

4.3.17.4 Future Occurrence

Monroe County's population has decreased over the last decade, so it can be assumed that local traffic has decreased slightly as well. However, with the increasing volume of goods and trucking through the county, transportation accidents will continue to occur routinely. Hazardous material release through transportation accidents is difficult to predict but can be assumed to

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

happen in future events as well. The U.S. Census Bureau reports the mean travel time to work for those aged 16 plus is approximately twenty-four minutes. Automobile accidents occur frequently, and typically occur more frequently than rail or aviation accidents. In the case of highway accidents, PennDOT has taken great strides to reduce the number of highway transportation accidents through programs such as the Pennsylvania Highway Safety Corridor. In this program, PennDOT designates sections of highway where traffic citation fines are doubled in the hopes that higher fines will deter unsafe driving and reduce accidents. Transportation accidents 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 municipal base maps.

4.3.17.5 Vulnerability Assessment

A transportation accident can occur anywhere in Monroe County. However, severe accidents are more likely to occur on the county's major highways due to the heavier traffic volumes which make highways extremely vulnerable. The vulnerability for accidents on either 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 include natural hazards that affect the environment, such as winter storms or heavy rains that cause slippery roadways or mud slides, to windstorms or tornadoes that cause high-profile vehicles or train cars to topple over. Loss of roadway use, and public transportation services would affect commuters, employment, delivery of critical municipal and emergency services, and day-to-day operations within the county.

With highway accidents, there is an added vulnerability that stems from the age and upkeep of bridges throughout the county. Unrepaired, deficient bridges may be more likely to break, thus leading to highway transportation damages or deaths. 19.8% of bridges in Monroe County are in poor condition, indicating an increased vulnerability to transportation accidents, while 57.7% remain in fair condition.

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 48 – Average Daily Traffic on Major Highway Vulnerability* identifies all major highways and railroads within Monroe County.

As part of the larger public outreach effort completed by the Monroe County Office of Emergency Management and the Monroe County Planning Commission, the public was asked to

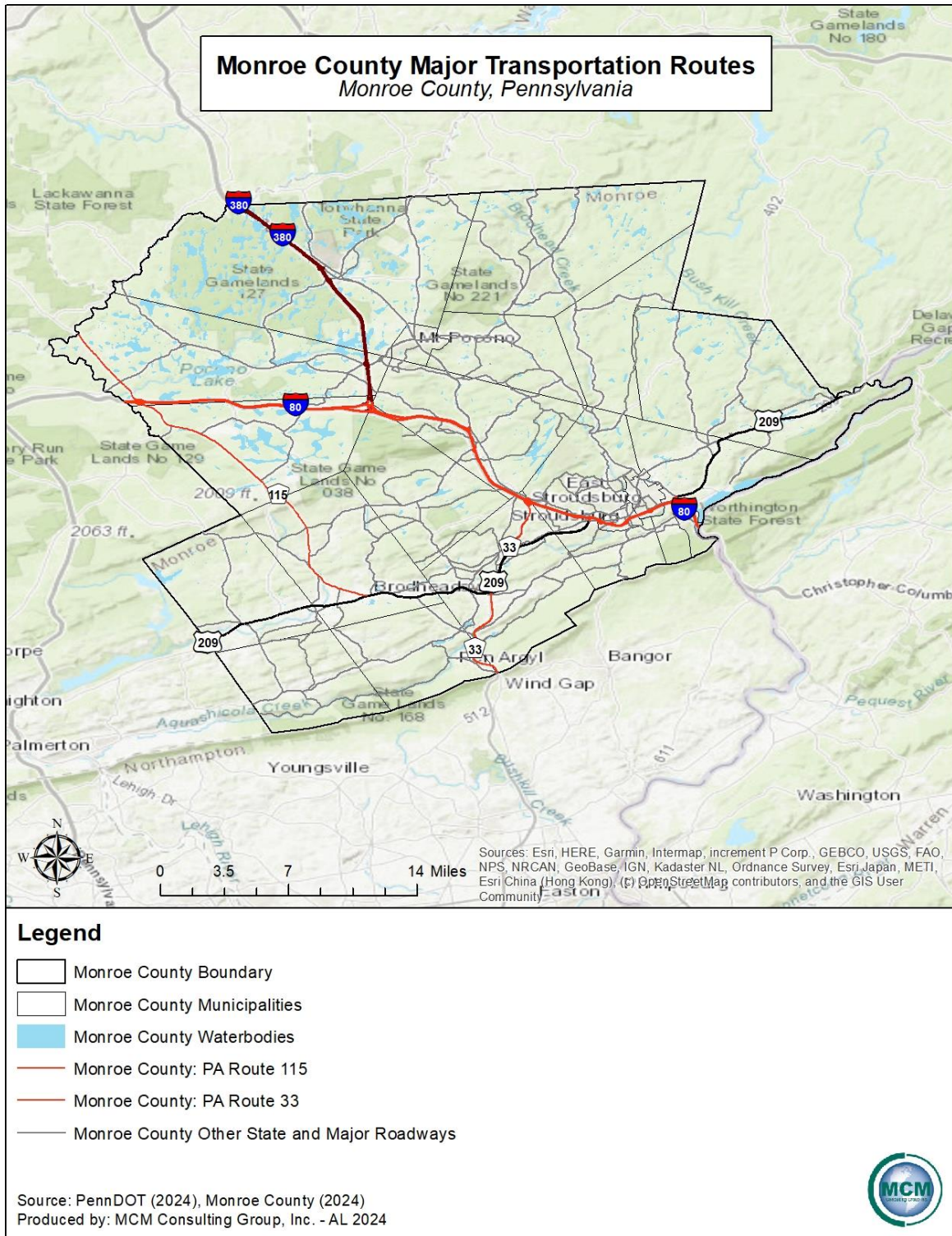
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

identify where major transportation accidents have previously occurred. The information outlined below includes but is not limited to specific areas of transportation vulnerability.

- East Stroudsburg Borough: There were two identified intersections that the public identified as having transportation accident concerns. Both of these locations are along N Courtland Street. The specific intersections are N Courtland Street at both 4th Street and 5th Street.
- Polk Township: Polk Township has two areas that the public identified as being vulnerable to transportation accidents. There locations are the intersection at Interchange Road and Hill Drive and along Interchange Road.
- Tobyhanna Township: The public outlined that transportation accidents could occur at the intersection of Locust Ridge Road and Caughbaugh Road.
- Tunkhannock Township: Route 115 was identified as the public as an area of concern for transportation accidents. This includes the intersection of Route 115 at Allegheny Drive and Mountain Road, the intersection at Colleen Drive, the intersection of Long Pond Road and just north of Game Lane.

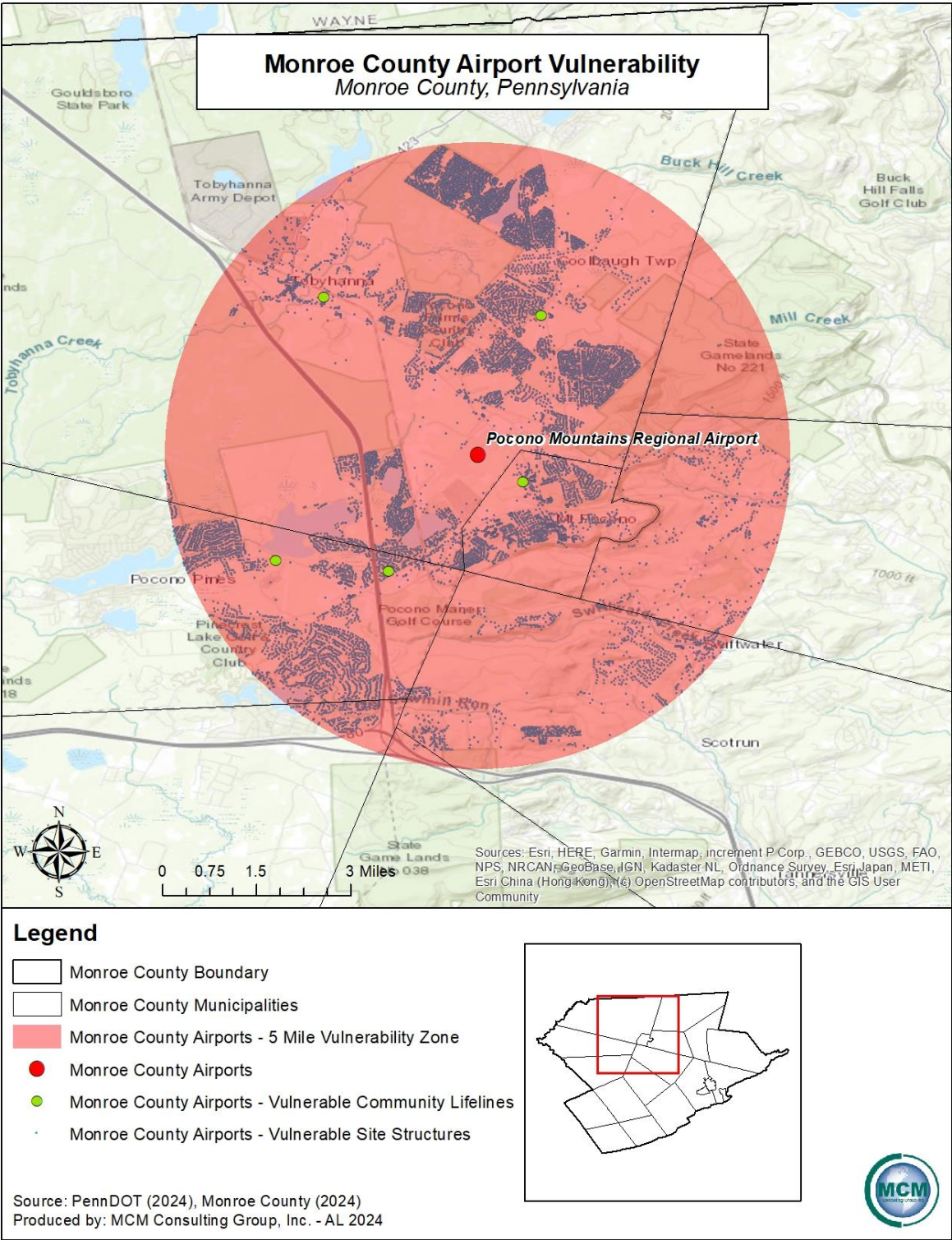
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Figure 46 - Major Transportation Routes



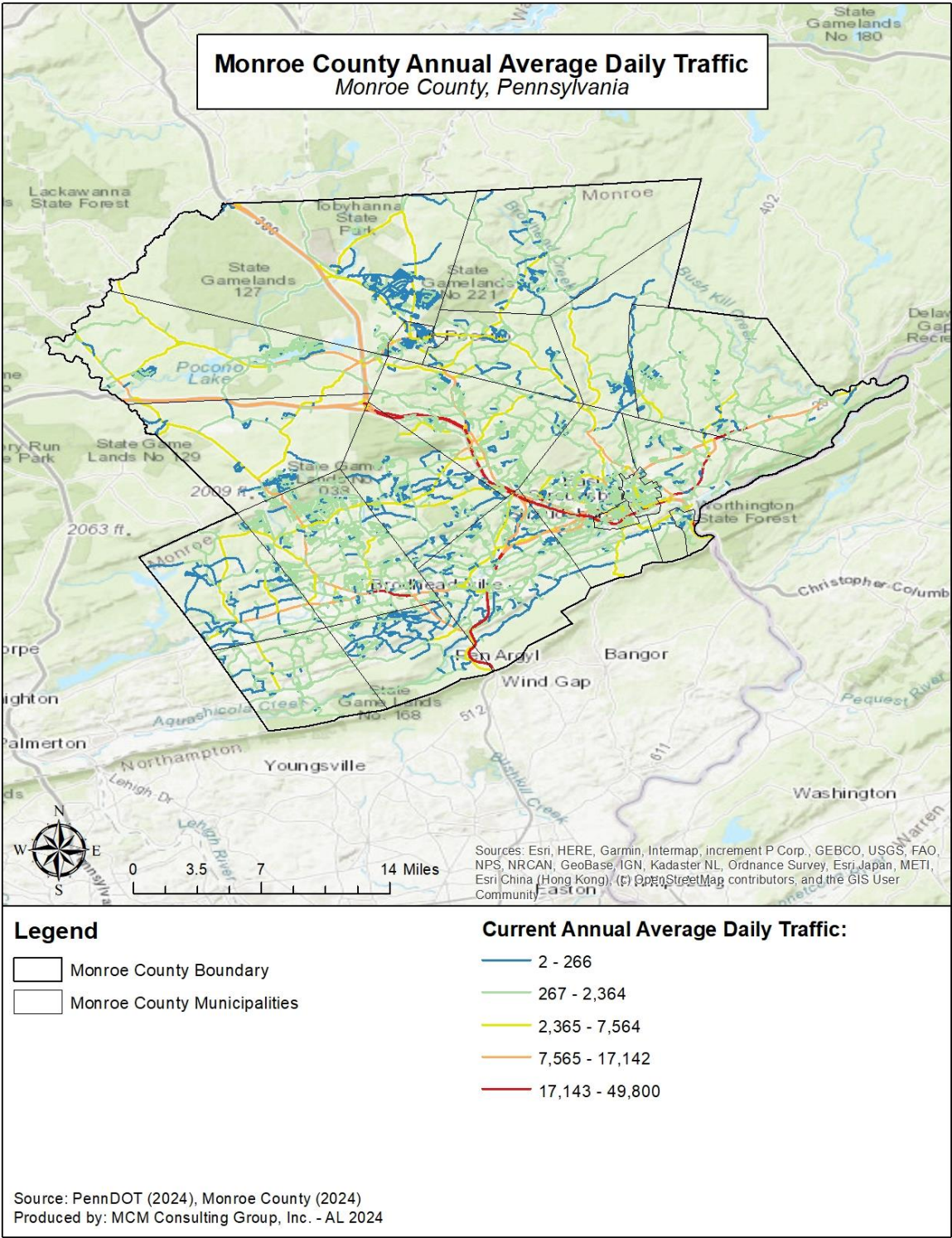
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Figure 47 - Airports and Vulnerability Zones



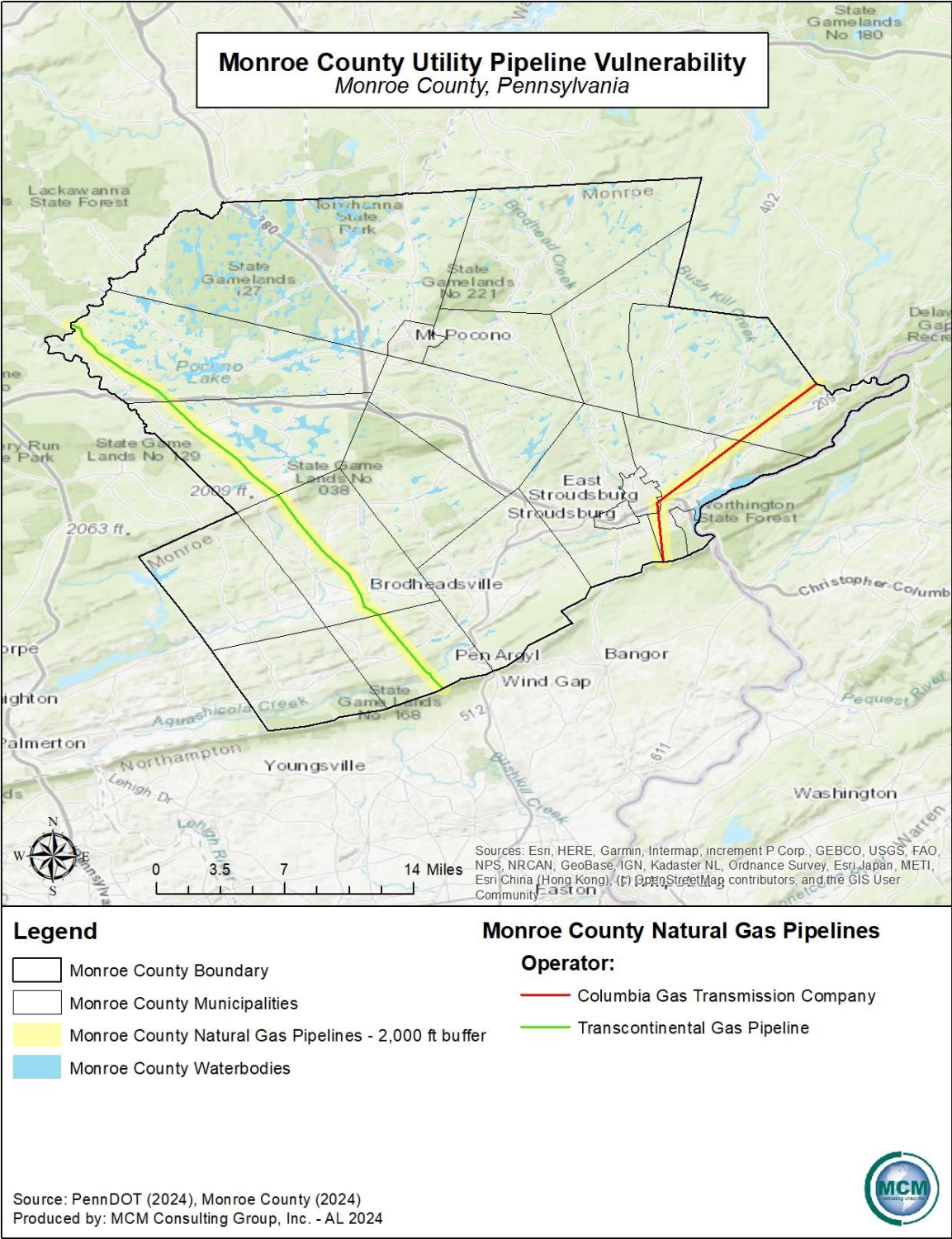
Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 48 - Average Daily Traffic on Major Highway Vulnerability



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 49 - Utility Pipelines Vulnerability



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

4.3.18. Utility Interruption

4.3.18.1 Location and Extent

Utility interruptions can occur from an internal system failure or as a secondary impact of another hazard, such as windstorm, winter storm, extreme temperatures, or a traffic accident. Strong adverse weather conditions and storms can cause widespread disruptions in electric and telecommunications service due to power lines being brought down by falling tree branches across a region. Strong heat waves may result in rolling blackouts where power may not be available for an extended period, impacting air conditioning across a region. Space weather, specifically solar flares, can also pose a threat to utility services across the globe. Although uncommon, the northeastern seaboard and the north central regions of the United States are particularly susceptible to this hazard.

The age of utility infrastructure also plays a 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 and temporary power outages and failures. Other causes for minor power outages include but are not limited to vehicle accidents and wire destruction due to animals or wildlife. Outages can also be caused by blown transformers or tripped circuit breakers in the electric system. Major power outages typically occur on a regional scale and can last both short term and long term.

The list of utility providers in Monroe County is shown in *Table 64 – Monroe County Utility Providers*.

Table 64 - Monroe County Utility Providers

Monroe County Utility Providers	
Utility Type	Name of Utility Provider
Electricity	Pennsylvania Power and Light (PP&L) and MetEd (FirstEnergy)
Telephone/9-1-1/Wireless	Frontier Communications, Palmerton Telephone Company, Verizon, AT&T, T-Mobile,
Natural Gas	TC Energy, UGI Utilities Inc., Williams Gas Pipeline, Public Service Electric & Gas (PSE&G)
Water	Brodhead Creek Regional Authority, East Stroudsburg Water
Source: PA Public Utility Commission, 2024	

4.3.18.2 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. Many utility interruptions occur during

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

storms or other severe weather events, and they can have secondary consequences. Typical secondary effects from a power outage can include a delay in emergency response and those services arriving in a timely manner. A lack of potable drinking water can also become a major issue for areas impacted by utility interruptions.

Electricity:

Interruptions or power failures could have the following impacts:

- Public safety concerns
- Food spoilage
- Loss of heating or air conditioning
- Basement flooding due to sump pump failure
- Loss of indoor lighting
- Loss of internet service
- Stopped and stalled elevators
- Direct economic impact from retail settings

Of all the above-listed impacts, the loss of heating or air conditioning poses the greatest risk to the elderly and very young populations during times of extreme temperature. Prolonged power outages also pose a risk to residents that rely on home-based medical equipment such as home-supply oxygen units. Some of the issues that are listed above can be considered more of a nuisance than a hazard, such as food spoilage due to long-term electrical outages. However, significant damage or harm can occur depending on the population affected, the duration, and the severity of the outage.

A worst-case scenario for the utility interruptions would be a county-wide power outage during winter months, forcing the evacuation of vulnerable populations to facilities outside of the county or to warming shelters within the county.

Fuel:

Interruptions of the transportation of gas and other products used for fuel can lead to a loss of heating and manufacturing capabilities. This can adversely affect the economic stability of a region and the production of needed products for consumption.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Telecommunications:

Interruptions to telecommunications systems include impacts to the 9-1-1 capabilities of a region, telephone, and internet service. The greatest risk in losing this utility to interruption is the risk of an emergency not being able to be reported to a public safety answering point (PSAP). Extensive loss of telephone and internet service can be detrimental to government, businesses, and to residents. With much of the country now dependent on wireless networks, signal interruptions can cause a large issue for people who are utilizing wireless telecommunications for work. There are also many concerns regarding safety and internet security due to the increase in people working over wireless networks that occurred during the COVID-19 pandemic. These interruptions and issues can be detrimental for the Monroe County workforce.

4.3.18.3 Past Occurrence

Minor utility interruptions occur annually in Monroe County and occur most often in conjunction with winter weather and/or windstorms. Monroe County utilizes a database system called WebEOC to track incidents within the county. Data from 2021 to 2024 has been recorded for many different incident types. *Table 65 – Utility Interruptions in Monroe County* illustrates the number of interruptions to electric, natural gas, telecommunications, and water services between 2021 and 2024.

Table 65 - Utility Interruptions in Monroe County

Utility Outages in Monroe County			
Location	Start Date	End Date	Event
Tunkhannock Township	02/01/2021	02/02/2021	Phone/communications outage
Tunkhannock Township	03/04/2021	03/04/2021	Phone/communications outage
Monroe County	04/30/2021	05/03/2021	Phone/communications outage
Monroe County	09/29/2021	10/04/2021	Mt. Pocono water main break (water shortage/outage)
Tobyhanna Township	03/08/2022	03/09/2022	Phone/communications outage
Stroud Township	04/28/2022	04/28/2022	Down power lines/fire (power outage)
Stroudsburg Borough	05/10/2022	05/11/2022	Monroe County email services
East Stroudsburg Borough	06/30/2022	07/01/2022	Water main break
Polk Township	07/18/2022	08/19/2022	Boil water advisory (water supply contamination)
Hamilton Township	07/18/2022	07/25/2022	Boil water advisory (water shortage/outage)
Jackson Township	07/18/2022	07/25/2022	Boil water advisory (water shortage/outage)

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Utility Outages in Monroe County			
Location	Start Date	End Date	Event
Eldred Township	07/28/2022	07/29/2022	Tree down on wires
Monroe County	09/01/2022	09/01/2022	Monroe Network Outage
Coolbaugh Township	12/25/2022	01/06/2023	Sanitary sewer overflow
Stroudsburg Borough	05/12/2023	05/12/2023	Gas main struck
Monroe County	08/22/2023	08/23/2023	Phone/communications outage
Monroe County	08/22/2023	08/23/2023	Verizon and T-Mobile service outage
Monroe County	09/07/2023	11/11/2023	911 notification outage
Hamilton Township	09/12/2023	11/29/2023	Phone outage
Hamilton Township	09/13/2023	09/15/2023	Wires down/road closure
Source: WebEOC™, Closed Incident Data 2024			

The Pennsylvania Public Utility Commission tracks the reliability of electric distribution companies (EDC) and outages. *Table 66 – 2018 Winter Storms Riley and Quinn Power Outages* by EDC compares the customers affected by power outage in Pennsylvania during these storm events and compares the to statistics from Nika from 2014 and Sandy from 2012. Some of the EDCs were not impacted by Winter Storm Quinn. PP&L customers experienced power outages for a duration of eight days with Winter Storm Quinn and Winter Storm Riley, whereas during Sandy in 2012, the duration was nine days. Nika in 2014 had a duration of just over three days.

Table 66 - 2018 Winter Storms Riley and Quinn Power Outages

2018 Winter Storms Riley and Quinn Power Outages			
Electric Distribution Company	Customers affected by storms Riley and Quinn 2018 (Percentage of total customers)	Customers affected by Nika 2014 (Percentage of total customer)	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%)
PCLP	2,101 (47.44%)	N/A	4,487 (100.00%)
PP&L	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			

Other past significant events of utility interruptions in the United States occur on a regional basis and can have varied effects related to number of impacted customers. A large water treatment plant failure occurred in Jackson, Mississippi in August of 2022 after flooding impacted the treatment facility. The city of Jackson was left without safe drinking water for close to two

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

months until the water was deemed safe and potable in October of 2022. This event stood out as a large scale failure of community lifelines and utilities. This event also opened discussions related to equity in infrastructure repairs, as the repairs took a significant amount of time in a vulnerable socio-economic area. An attack on an electrical grid and power substations in North Carolina in December of 2022 left almost 45,000 people without power and reliant heat during the cold temperatures of January.

4.3.18.4 Future Occurrence

Utility Interruptions are difficult to predict, and 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.

Space weather is getting more attention as an infrastructure risk due in part to a March 2020 report by the United States Geological Survey (USGS). The report noted that geomagnetic storms caused by the dynamic action of the Sun and solar wind on the space environment surrounding the Earth can generate electric fields in the Earth's crust and mantle. These electric fields can interfere with the operation of grounded electric power-grid systems. Geomagnetic storms occur only occasionally, but when sufficiently energetic they can produce blackouts on a large scale.

As utility infrastructure ages, interruption events could occur more frequently if the maintenance of the infrastructure is not maintained. Utility providers can reduce Monroe County's vulnerability to power outages by implementing improvement plans for utility infrastructure. Total replacement is not a feasible solution to the issue, but compromises can be reached to ensure that the new and old equipment along a utility line can work together efficiently.

Utility interruptions could see direct impacts based on climate change in Monroe County. Prolonged heat waves caused by climate change could stress a power grid that was not specifically designed for increased heat exposure. Increased intensity of winter storms is of particular concern for the Commonwealth of Pennsylvania, as power outages can occur from lines being brought down by ice and snow.

4.3.18.5 Vulnerability Assessment

Resources such as electricity, communications, gas, and water supply are critical to ensure the health, safety, and general welfare of the citizenry. *Figure 50 – Monroe County Utilities* illustrates the approximate locations of service lines and pipelines throughout Monroe County.

Power outages can cause even greater detriment to at-risk and vulnerable populations, such as elderly (e.g., supplemental oxygen power needs) or those with functional and access needs to

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

consider. All critical infrastructure is vulnerable to the effects of a power surge. 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 offset electrical needs during extreme hot or cold temperature events. 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 grid power source to the emergency generator. When officials consider maintenance and supplies for a facility, long-term use of back-up generators should be planned.

Electricity:

Severe weather is one of the largest causes of power loss. The electric power grid infrastructure can be damaged by snow, ice, high winds, lightning, flooding, falling tree limbs, and vehicle accidents involving utility poles. Small animals can also cause minor power outages by climbing along the lines and shorting out the system.

Causes of a regional scale power outage or failure could be from infrastructure failure, sabotage, human error, or worker strikes. Community lifeline facilities are vulnerable to utility interruptions, especially the loss of power. The establishment of reliable backup power at these facilities is extremely important to provide continued support of the health, safety, and well-being of Monroe County residents and visitors.

The occurrence of severe weather-related utility interruptions will increase due to climate change in the Commonwealth of Pennsylvania and the United States as a whole. Climate change will cause weather to become more severe on a more frequent basis.

Water:

Water distribution can be affected in three ways.

- The amount of water available (depends on nature)
- The quality of the water (depends on human responsibility)
- The viability of the physical components of the distribution system

Well contamination or water shortages due to drought could pose a high vulnerability to local water distribution. Drought events will continue to occur more frequently as climate change alters that available amount of ground water for consumption. This will result in greater well shortages and water utility interruptions for citizens that have well water.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Water contamination can occur naturally, by human error, or intentionally. Releases of manure and milk into the water supply can cause contamination. Overflows from sewage systems and lagoons on farms can also cause contamination of groundwater and drinking water. There are times when accidental spills and releases of hazardous materials contaminate water supplies, thereby, water supplies along transportation routes may be affected.

Gas and Liquid Pipelines:

Interruptions to natural gas distribution lines could be affected by:

- Deterioration of line and facilities
- Puncturing the distribution lines by humans (either intentional or accidental)
- Coastal or winter storms
- Extreme heat or cold events
- Transportation accidents

Communications:

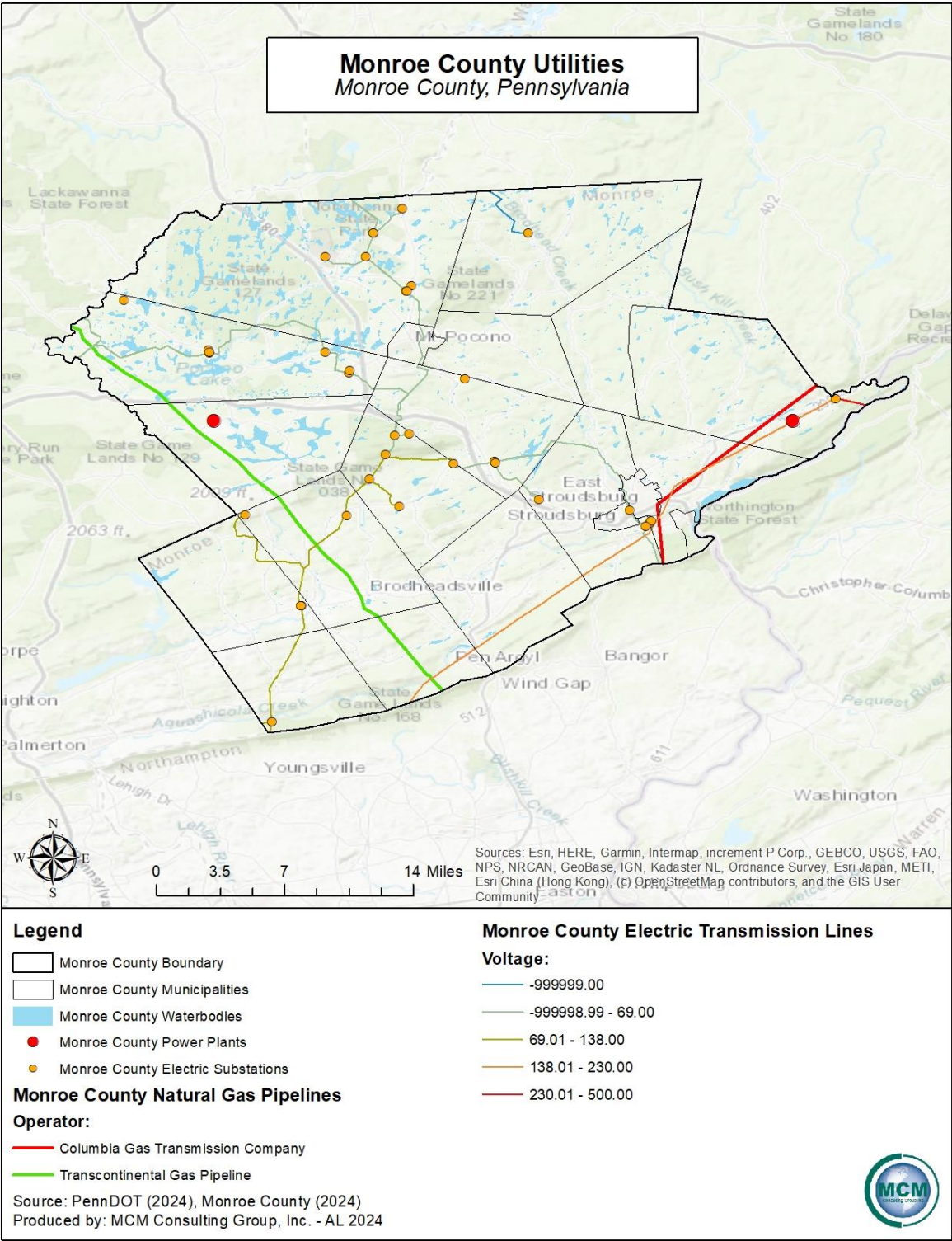
Interruptions in communications could be caused as a secondary effect of storms or high winds, infrastructure failure, or by humans (intentional or accidental). A loss of communications by emergency services would be devastating to the population of Monroe County if 9-1-1 calls could not be received, or if emergency units could not be dispatched properly and/or timely.

No data regarding economic impacts from utility interruptions in Monroe County are available. However, utility interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners or operators of the utility facilities, and costs to government and community service groups.

There were a large number of utility interruptions outlined by the public in Monroe County's outreach strategy. These locations included at least three utility interruption locations for Barrett Township, two for Chestnuthill Township, one for Delaware Water Gap Borough, one for Jackson Township, one for Middle Smithfield Township, two for Pocono Township, four for Ross Township, three for Stroud Township, three for Tobyhanna Township, and four for Tunkhannock Township. This is at least twenty-four utility interruption occurrences noted by the public in Monroe County.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Figure 50 - Monroe County Utilities



Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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, 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. The weighting factor agreed upon by the planning team is shown in *Table 67 – Risk Factor Approach Summary*. 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:

Table 67 - Risk Factor Approach Summary

Risk Factor Value =

$$[(\text{Probability} \times .30) + (\text{Impact} \times .30) + (\text{Spatial Extent} \times .20) + (\text{Warning Time} \times .10) + (\text{Duration} \times .10)]$$

Table 68 – Risk Factor Approach Summary Cont'd 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 68 - Risk Factor Approach Summary Cont'd

Summary of Risk Factor Approach Used to Rank Hazard Risk.					
RISK ASSESSMENT CATEGORY	DEGREE OF RISK			WEIGHT VALUE	
	LEVEL	CRITERIA	INDEX		
PROBABILITY <i>What is the likelihood of a hazard event occurring in a given year?</i>	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 PROBABILITY	4		
IMPACT <i>In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?</i>	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 <i>How large of an area could be impacted by a hazard event? Are impacts localized or regional?</i>	NEGLECTIBLE	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 <i>Is there usually some lead time associated with the hazard event? Have warning measures been implemented?</i>	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 <i>How long does the hazard event usually last?</i>	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	

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, *Table 69 – Risk Factor Assessment* lists the risk factor calculated for each of twenty potential hazards identified in the 2025 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 69 - Risk Factor Assessment

Monroe County Hazard Ranking Based on Risk Factor Assessment Methodology							
Hazard Risk	Hazard Natural (N) or Human Caused (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		Probability	Impact	Spatial Extent	Warning Time	Duration	
HIGH	Substance Use Disorder (H)	4	4	4	1	4	3.7
	Cyberterrorism (H)	4	4	4	4	1	3.7
	Endemic (N)	4	3	4	2	4	3.5
	Invasive Species (N)	4	3	4	1	4	3.4
	Pandemic, Epidemic, and Infectious Disease (N)	2	4	4	2	4	3.2
	Transportation Accidents (H)	4	3	3	4	1	3.2
	Flash Flooding (N)	4	2	3	4	2	3.0
	Hurricane/Tropical Storm (N)	3	3	4	2	2	3.0
	Utility Interruptions (H)	4	2	2	4	3	2.9
	Winter Storm (N)	4	2	4	1	2	2.9
	Flooding (N)	2	3	4	2	3	2.8
	Windstorm (Straight Line) (N)	4	2	3	2	1	2.7
	Wildfire (N)	3	2	2	4	2	2.5
MODERATE	Disorientation (H)	4	1	1	4	3	2.4
	Drowning (H)	4	1	1	4	2	2.3
	Extreme Temperatures (N)	3	1	3	1	3	2.2
	Dam Failure (H)	1	3	2	4	2	2.2
	Environmental Hazards – Fixed Facility (H)	2	2	2	4	2	2.2
	Environmental Hazards – Transportation (H)	4	1	1	4	1	2.2
	Terrorism – Domestic (H)	2	2	2	4	2	2.2

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Hazard Ranking Based on Risk Factor Assessment Methodology							
Hazard Risk	Hazard Natural (N) or Human Caused (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		Probability	Impact	Spatial Extent	Warning Time	Duration	
	Tornadoes (N)	2	2	2	4	1	2.1
	Terrorism – International (H)	2	2	2	4	1	2.1
	Drought (N)	2	1	3	1	4	2.0
	Levee Failure (H)	1	3	1	3	3	2.0
LOW	Nuclear Incident (H)	1	1	2	4	3	1.7
	Subsidence and Sinkhole (N)	1	1	1	4	4	1.6
	Ice Jam Flooding (N)	2	1	1	2	3	1.6

Based on these results, there are thirteen high risk hazards, eleven moderate risk hazards, and three 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.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. *Table 70 – Countywide Risk Factor Assessment* shows the different municipalities in Monroe County and what their evaluated risk factor assessment score is compared to the county’s score. This table was developed by the consultant based on the findings in the hazard profiles located in sections 4.3.1 through 4.3.18.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 70 - Countywide Risk Factor

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk									
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR									
JURISDICTION	Substance Use Disorder	Cyberterrorism	Endemic	Invasive Species	Pandemic, Epidemic, and Infectious Disease	Transportation Accidents	Flash Flooding	Hurricane/Tropical Storm	Utility Interruptions
	3.7	3.7	3.5	3.4	3.2	3.2	3.0	3.0	2.9
Barrett Township	2.8	2.6	0	2.7	2.5	2.2	1.7	1.6	3.2
Chesnuthill Township									
Coolbaugh Township	3.2	2.7	0	3.1	3.3	3.5	3.5	2.3	3.7
Delaware Water Gap Borough									
East Stroudsburg Borough	2.8	2.9	0	2.5	2.6	2.8	2.5	2.6	3.1
Eldred Township									
Hamilton Township	2.7	2.1	0	2.6	2.6	3.0	2.6	3.0	3.1
Jackson Township	2.2	2.8	0	2.3	2.8	2.4	1.9	2.2	4.0
Middle Smithfield Township	2.7	2.9	0	3.4	2.0	2.8	3.1	2.8	3.8
Mount Pocono Borough	1.3	2.8	0	2.4	2.5	2.3	2.4	2.3	2.7
Paradise Township	2.8	3.0	0	3.6	4.0	2.5	2.7	2.4	2.8
Pocono Township	2.2	2.5	0	2.5	2.8	2.7	3.0	2.5	3.4
Polk Township	1.6	3.5	0	2.0	2.9	3.0	3.0	2.1	3.1
Price Township									
Ross Township	2.0	2.0	0	2.0	1.0	2.0	2.0	1.0	2.0
Smithfield Township	3.2	1.9	0	2.6	2.8	2.8	2.4	2.6	3.0
Stroud Township	3.5	1.9	0	2.2	3.4	3.2	2.2	1.5	2.8
Stroudsburg Borough	3.4	2.8	0	1.3	2.8	1.6	2.9	3.1	3.0
Tobyhanna Township	3.1	2.7	0	2.8	3.1	3.2	1.7	2.1	3.1
Tunkhannock Township	2.1	3.4	0	3.4	2.4	2.7	2.9	3.1	3.2

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk									
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR									
JURISDICTION	Winter Storm	Flooding	Windstorm (Straight Line)	Wildfire	Disorientation	Drowning	Extreme Temperatures	Dam Failure	Environmental Hazards – Fixed Facility
	2.9	2.8	2.7	2.5	2.4	2.3	2.2	2.2	2.2
Barrett Township	2.9	2.0	2.9	2.5	1.9	2.2	1.4	2.5	1.7
Chesnuthill Township									
Coolbaugh Township	3.3	2.1	2.4	3.1	2.3	3.0	2.7	3.3	2.0
Delaware Water Gap Borough									
East Stroudsburg Borough	3.0	2.0	3.0	1.6	1.9	2.2	2.4	2.9	2.8
Eldred Township									
Hamilton Township	3.0	2.3	3.0	2.5	1.8	1.6	2.4	1.2	2.1
Jackson Township	2.3	1.6	2.4	2.6	1.6	1.6	2.1	1.7	2.2
Middle Smithfield Township	3.6	2.9	3.5	3.0	1.1	1.9	3.0	2.7	2.5
Mount Pocono Borough	2.8	2.4	2.0	2.5	1.0	1.3	2.9	1.2	1.5
Paradise Township	3.4	2.9	2.4	2.5	1.5	1.9	2.8	1.4	2.7
Pocono Township	2.9	3.0	1.9	2.2	1.4	1.6	2.7	2.4	2.2
Polk Township	2.7	3.0	2.6	2.9	1.9	1.3	2.4	1.7	2.6
Price Township									
Ross Township	2.0	2.0	1.0	2.0	1.0	1.0	2.0	1.0	1.1
Smithfield Township	2.7	2.3	2.5	2.2	2.2	2.1	2.4	2.2	2.0
Stroud Township	2.0	2.3	1.0	1.9	1.0	2.2	2.3	2.5	2.0
Stroudsburg Borough	2.6	2.6	2.3	2.3	1.3	1.3	2.2	1.5	1.5
Tobyhanna Township	2.7	1.7	2.5	2.9	1.9	2.2	2.7	2.3	2.7
Tunkhannock Township	3.4	2.7	2.6	3.1	2.0	1.3	1.7	3.0	2.3

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk									
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR									
JURISDICTION	Environmental Hazards - Transportation	Terrorism - Domestic	Tornadoes	Terrorism - International	Drought	Levee Failure	Nuclear Incident	Subsidence and Sinkhole	Ice Jam Flooding
	2.2	2.2	2.1	2.1	2.0	2.0	1.7	1.6	1.6
Barrett Township	1.9	2.6	2.9	2.6	1.5	1.0	3.1	0	1.2
Chesnuthill Township									
Coolbaugh Township	3.5	2.7	2.4	2.7	2.4	2.4	1.0	2.5	1.0
Delaware Water Gap Borough									
East Stroudsburg Borough	3.5	2.9	3.0	2.9	2.2	2.6	3.1	1.4	1.2
Eldred Township									
Hamilton Township	2.5	2.1	3.0	2.1	2.8	0	2.8	2.5	2.0
Jackson Township	2.2	2.8	2.4	2.8	2.5	1.8	3.1	1.4	1.3
Middle Smithfield Township	2.2	2.9	3.5	2.9	2.8	1.5	1.1	1.5	2.9
Mount Pocono Borough	1.5	2.8	2.0	2.8	2.2	1.2	2.8	2.0	1.3
Paradise Township	2.7	3.0	2.4	3.0	2.3	1.0	3.0	1.4	2.1
Pocono Township	2.5	2.5	1.9	2.5	2.2	1.0	2.3	2.0	1.2
Polk Township	2.3	3.5	2.6	3.5	2.7	1.1	1.1	1.0	1.0
Price Township									
Ross Township	1.1	2.0	1.0	2.0	2.0	1.1	1.1	1.0	1.0
Smithfield Township	1.7	1.9	2.5	1.9	2.2	2.4	2.5	1.7	1.3
Stroud Township	2.1	1.9	1.0	1.9	2.4	1.8	1.0	1.0	1.0
Stroudsburg Borough	2.5	2.8	2.3	2.8	1.3	2.8	3.1	1.5	1.6
Tobyhanna Township	3.0	2.7	2.5	2.7	2.8	1.9	2.0	1.6	1.7
Tunkhannock Township	2.8	3.4	2.6	3.4	2.4	1.5	1.7	1.2	2.1

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

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 \$148.33 million with 36.47% 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 \$277.11 million.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

4.4.4. Future Development and Vulnerability

The 2020 census population for Monroe County is 168,327, which is 1,515 fewer than the 2010 census. There was an overall decrease of 0.9% in population, based on the data. Nine municipalities have seen population increases while the remaining thirteen had decreases in the period between 2010 and the 2020, as identified in *Table 71 – 2010 – 2020 Population Change*.

Table 71 - 2010 – 2020 Population Change

Population Change in Monroe County from 2010-2020			
Municipality	2010 Census	2020 Census	Percent of Change 2010-2020
Barrett Township	4,260	4,120	-3.3
Chestnuthill Township	17,072	16,879	-1.1
Coolbaugh Township	20,060	20,451	1.9
Delaware Water Gap Borough	794	661	-16.8
East Stroudsburg Borough	10,000	10,232	2.3
Eldred Township	2,898	2,936	1.3
Hamilton Township	9,134	8,905	-2.5
Jackson Township	7,002	6,888	-1.6
Middle Smithfield Township	15,556	15,798	1.6
Mount Pocono Borough	3,172	3,106	-2.1
Paradise Township	3,175	3,120	-1.7
Pocono Township	11,068	10,975	-0.84
Polk Township	7,810	7,724	-1.1
Price Township	3,481	3,673	5.5
Ross Township	5,991	5,875	-1.9
Smithfield Township	7,217	7,515	4.1
Stroud Township	18,716	19,160	2.4
Stroudsburg Borough	5,733	5,514	-3.8
Tobyhanna Township	8,326	8,532	2.5
Tunkhannock Township	6,615	6,760	2.2
Source: United States Census Bureau (2024), 2020 Census Data			

The 2023 census estimates indicates that there are approximately 79,377 housing units in Monroe County, Pennsylvania. Of those, 74.5% of the structures are occupied-housing units. The county-wide population changes indicate a potential alteration to overall hazard vulnerability. Municipalities that undergo widespread population reductions may have more difficulty meeting personnel demands than expanding jurisdictions. However, certain municipalities experienced

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

significant resident increases and thus, may be more vulnerable to certain hazards due to development and residential growth. Although expanding population zones may be especially vulnerable to hazards outlined in section 4.3 of this hazard mitigation plan update, natural and human caused hazards could potentially occur at any time regardless of population change. The Monroe County Hazard Mitigation Local Planning Team will conduct annual reviews of this plan and the impacts all hazards have on the county and new development every year and within a time frame after a disaster or major emergency.

As discussed above in the community profile, future development in Monroe County includes specific concerns on transportation and traffic patterns. Community members in Monroe County were included in the planning process and community information is included in an additional appendix for this hazard mitigation plan update. Any future development in Monroe County should be reviewed for traffic accessibility, to ensure ingress and egress for emergency services.

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, 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. The meetings were designed to seek input from the key county and municipal stakeholders on legal, fiscal, technical, and administrative capabilities of all jurisdictions. As such, the capabilities assessment guides 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. Therefore, these capability assessments consider the various characteristics and capabilities of municipalities under study.

The evaluation of the following categories – political framework, legal jurisdictions, 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 several 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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

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

Each plan participant has some ability to expand and improve upon their administrative and technical capabilities following this plan update and during an update process. The municipalities of Monroe County could improve upon these capabilities by first reviewing the capability assessment forms submitted during this update process and identifying areas of growth based off of these forms. A comprehensive review is within the power of each municipality of Monroe County to see what departments, commissions, boards, and staff they have available to assist in each aspect of capability assessments. Each municipality, as a plan participant, should assess if they have the ability to improve in these areas during an annual review process or during the next hazard mitigation plan update. The plan participants should also review their ability to improve the financial capabilities by reviewing funding and funding sources, and researching other funding sources for hazard mitigation processes. Each plan participant can improve their education and outreach capabilities by increasing public event participation and education events that they attend in the county.

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 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, 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, and adoption of the Pennsylvania Floodplain Management Act (Act 166 of 1978) established even higher floodplain management 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 and the municipal 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 that exist in that area. Consequently, structures that are built according to applicable codes are inherently resistant to many hazards, such as intense 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 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 Pennsylvania 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 Code (Act 45). All municipalities in Monroe County have their own building code enforcement. Most of the municipalities in Monroe County utilize additional planning partners, agencies, or private

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

businesses for building code enforcement. Further information on community specifics can be found in the submitted community capability assessments for Monroe County.

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, and 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.

Subdivision Ordinance

Subdivision and land development ordinances include regulations to control the layout of streets, the planning lots and the provision of utilities and other site improvements. The objectives of subdivision and land development ordinance are to coordinate street patterns, to assure adequate utilities and other improvements are provided in a manner that will not pollute streams, wells and/or soils, to reduce traffic congestions, and to 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 of the twenty municipalities in Monroe County utilize some form of land use and land development regulations.

Stormwater Management Plan/Stormwater Ordinance

The proper management of storm water runoff can improve conditions and decrease the chance of flooding. Pennsylvania's Storm Water Management Act (Act 167) confers on counties the responsibility for development of watershed plans. The Act specifies that counties must complete their watershed storm water plans within two years following the promulgation of these guidelines by the Pennsylvania Department of Environmental Protection (PA DEP), which may grant an extension of time for 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. 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 storm water management plan by amending or adopting laws and regulation for land use and development. The implementation of storm water management criteria and standards at

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

the local level are necessary since municipalities are responsible for local land use decisions and planning. The degree of detail in the ordinance depends on the extent of existing and projected land development. The watershed storm water 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 storm water 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 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.

Regarding 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 consider 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 that recommends considering storm drainage and floodplain management.

Monroe County last updated its comprehensive plan in 2014.

Article III of the MPC enables municipalities to prepare a comprehensive plan: however, development of a comprehensive plan is voluntary. Eight of the twenty municipalities in Monroe County have adopted their own comprehensive plans. Coolbaugh Township, Mount Pocono Borough, Tobyhanna Township, and Tunkhannock Township have a regional comprehensive plan that was adopted in June of 2005. Hamilton Township, Pocono Township, Stroud Township, and Stroudsburg Borough have a regional comprehensive plan that was adopted in August and September of 2022. Chestnuthill Township, Jackson Township, Eldred Township, Ross Township, and Polk Township have a regional comprehensive plan. All municipalities in Monroe County have a comprehensive plan in place.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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, storm water 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 a capital improvement plan in place at the time of this writing.

Participation in the National Flood Insurance Program (NFIP)

Floodplain management is the operation of programs or activities that may consist of both corrective and preventative 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) require every municipality identified by the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program 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 ensures that the risk of flood damage is not increased by property development.

The Pennsylvania Emergency Management Agency (PEMA) was appointed by legislation in September 2021 to coordinate the Commonwealth NFIP and employ the State NFIP Coordinator. For many years prior, these roles were held by the Pennsylvania Department of Community and Economic Development (DCED), which still offers support to communities through its Floodplain Mitigation Program. PEMA provides communities, based on 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, the below.

1. Prohibiting manufactured homes in the floodway
2. Prohibiting manufactured homes within the area measured fifty 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 structure

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

5. Prohibiting new construction and development within the area measured fifty 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 established 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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. FEMA 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 established 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 of the municipalities in Monroe County have floodplain regulations in place that meet the requirements of the National Flood Insurance Program (NFIP). This information was retrieved from FEMA's listing of participating communities. Currently, no municipalities have completed or started to complete the CRS program. Additional research will be conducted on the CRS program and mitigation actions will be developed in support of the CRS.

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, fourteen municipalities submitted an NFIP survey. These surveys can be found in Appendix C of this plan.

The following information outlines floodplain ordinances from jurisdictions in Monroe County that have not submitted NFIP surveys during this hazard mitigation planning process.

Additional National Flood Insurance Program and Floodplain Management Information:

Price Township:

The floodplain management ordinance for Price Township was not available for review during this hazard mitigation plan update. The floodplain administrator designee for Price Township is Robert Wilson.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Ross Township:

The floodplain management ordinance for Ross Township was not available for review during this hazard mitigation plan update. The floodplain administrator designee for Ross Township is Shawn McGlynn.

Each community within Monroe County should identify their procedures for substantial improvement and substantial damage implementation in their floodplain management ordinance. This is a concern for local municipalities and plan participants if those locations are not aware of where their floodplain management ordinance is located, or what is in the ordinance. Each municipality may have different processes and procedures in place for substantial improvement and substantial damage following an event. Floodplain management ordinance maintenance, access, and implementation can be a challenge for municipalities and local governments, and this also relates to the availability of information on SI/SD.

During this hazard mitigation plan update, a previous National Flood Insurance Program (NFIP) survey was used. This document was utilized and distributed to the municipalities prior to the “Checking In on the NFIP” document being provided to MCM Consulting Group, Inc. The “Checking In on the NFIP” document was not distributed to municipalities, so they did not have two separate versions of the NFIP survey. This new document will be used for future hazard mitigation plan development in Monroe County.

The following table outlines the Monroe County municipality floodplain administrator designees or representative. This information was retrieved from the Pennsylvania Department of Community and Economic Development at the following website: <https://dced.pa.gov/local-government/municipal-statistics/municipalities/> or https://apps.dced.pa.gov/munstats-public/ReportInformation2.aspx?report=LocalOfficial_Excel

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 72 - Monroe County Municipal Floodplain Administrator Designees

Monroe County Municipal Floodplain Administrator Designees		
Municipality Name	Position Title	Name or Agency
Barrett Township	Flood Plain Administrator	Jeryl Rinehart
Chestnuthill Township	Flood Plain Administrator	Matthew Neeb
Coolbaugh Township	Flood Plain Administrator	Tomas Keane
Delaware Water Gap Borough	Flood Plain Administrator	Walter Conway
East Stroudsburg Borough	Flood Plain Administrator	Lee Philips
Eldred Township	Flood Plain Administrator	Shawn McGlynn
Hamilton Township	Flood Plain Administrator	SFM Consulting
Jackson Township	Flood Plain Administrator	Michelle Arner
Middle Smithfield Township	Flood Plain Administrator	Shawn McGlynn
Mount Pocono Borough	Flood Plain Administrator	Marissa Duffy
Paradise Township	Flood Plain Administrator	Shawn McGlynn
Pocono Township	Flood Plain Administrator	T&M Associates
Polk Township	Flood Plain Administrator	Tracy Herman
Price Township	Flood Plain Administrator	Robert Wilson
Ross Township	Flood Plain Administrator	Shawn McGlynn
Smithfield Township	Flood Plain Administrator	Matthew Helbers, Bureau Veritas
Stroud Township	Flood Plain Administrator	Steve Fylstra
Stroudsburg Borough	Flood Plain Administrator	Lawrence E. Kopp
Tobyhanna Township	Flood Plain Administrator	Lourdes Aponte
Tunkhannock Township	Flood Plain Administrator	Kate Lambert

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. Other municipalities choose to operate independently and provide such services internally. Municipalities vary in staff size, resource availability, fiscal status, service provision, constituent population, overall size, and vulnerability to the profile hazards. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract resources for this expertise in order to effectively execute mitigation.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

activities. Common examples of skill sets, and technical personnel needed for hazard mitigation include: planners with knowledge of land development and management practices, engineers or professionals trained in construction practices related to buildings and/or infrastructure (e.g. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with education of expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, fiscal staff to handle complex grant application processes.

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 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.

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. Most municipalities in Monroe County have a municipal engineer under contract to perform these duties.

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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Commission , which is available to assist all the county’s municipalities. GIS data is an important tool to use in hazard mitigation planning and is instrumental in assessing the risk of municipalities to various hazards.

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. Hence, the National Preparedness Goal of 2011 also defines what it means for the whole community to be prepared for all types of disasters and emergencies and lists five mission areas which support preparedness: prevention, protection, mitigation, response, and recovery – doubling the emphasis on mitigation activities in an emergency management program.

The Pennsylvania Emergency Management Services Code (PA 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 hazardous events have on their community.

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 §7633.

- Prepare and maintain a current disaster emergency management plan
- Establish, equip, and staff an emergency operations center
- Provide individual and organizational 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 public
- Participate in all tests, drills, and exercises, including remedial drills and exercises, scheduled by the agency or by the federal government

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

PA Title 35 requires that all municipalities in the Commonwealth have a local emergency operations plan (EOP) which is updated every two years. All municipalities in Monroe County have emergency operation plans in place, but the updating of those plans and the status is unknown by the Monroe County Planning Commission and the Monroe County Office of Emergency Management. The notification and resource section of the plan was developed individually by each municipality.

Federal Agency Assistance

There are many federal agencies that can provide technical assistance for mitigation activities, and these include, but are not limited to:

- United States Army Corps of Engineers (USACE)
- Department of Housing and Urban Development (HUD)
- Department of Agriculture (DOA)
- Economic Development Administration (EDA)
- Emergency Management Institute (EMI)
- Environmental Protection Agency (EPA)
- Federal Emergency Management Agency (FEMA)
- Small Business Administration (SBA)

State Agency Assistance

There are many Commonwealth agencies that can provide technical assistance for mitigation activities, and these include but are not limited to:

- Pennsylvania Emergency Management Agency (PEMA)
- Pennsylvania Department of Community and Economic Development (PA DCED)
- Pennsylvania Department of Conservation and Natural Resources (PA DCNR)
- Pennsylvania Department of Environmental Protection (PA DEP)

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 municipal representatives will need to rely on regional, state, and federal partnerships for future financial assistance and the development of intra-county regional partnerships and intra-municipality regional partnerships may assist in bolstering this process.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Emergency Services

The state of emergency services in Monroe County matches the characteristics across the Commonwealth of Pennsylvania. There has been a decline in the number of emergency service providers and personnel resulting in the potential for longer response times, especially in rural and remote communities. In Monroe County, and Pennsylvania as a whole, emergency service providers are primarily staffed by volunteers. This results in a shortage of personnel if new volunteers are not recruited and added to the service. Across Pennsylvania, recruitment and retention has decreased and the current emergency service personnel are older Pennsylvanians. There is not a large number of young volunteers in the fire service across the county and Pennsylvania when compared to older adult volunteers.

There are twenty fire stations or fire departments in Monroe County. The fire stations are distributed evenly across the county and the municipalities. There are also five police departments in Monroe County, including the Pennsylvania State Police with multiple barracks, two regional police departments, one borough police department and one township police department. The regional and local police departments are Stroud Area Regional Police, the Pocono Mountain Regional Police, the Delaware Water Gap Police Department, and the Pocono Township Police Department. In addition to the fire departments and police departments noted above, there are also five emergency medical services departments located throughout Monroe County. These EMS services provide emergency medical care and transportation services for patients in the county.

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 decision and capacity to implement mitigation-related activities is often strongly dependent on the presence of financial resources. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on survey results, some municipalities within the county perceive fiscal capability to be moderate. 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 many 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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.”

Grant programs that may be utilized to accomplish hazard mitigation objectives include the: Pennsylvania Department of Community and Economic Development Community Development Block Grant (CDBG); Land Use Planning and Technical Assistance (LUPTAP); Shared Municipal Services (SMS); Community Revitalization (CR) and Floodplain Land Use Assistance Programs; the PA DEP’s Growing Greener; Act 167 Stormwater Management; Source Water Protection; and Flood Protection Programs. The Flood Protection Programs include the PA DCNR’s Community Conservation Partnership Program, PEMA’s Pre-Disaster Mitigation (PDM) Grant, Flood Mitigation Assistance Grant Programs (FMA), and Hazard Mitigation Grant Program.

Below are some of the other state programs that may provide financial support for mitigation activities:

- DCED Flood Mitigation Program
- DCED H2O PA Flood Control Projects
- DCED H2O PA High Hazard Unsafe Dam Projects
- DCED H2O PA Water Supply, Sanitary Sewer and Storm Water Projects
- DCED PA Small Water and Sewer
- DCNR Community Conservation Partnerships Program
- DCNR Pennsylvania Heritage Areas Program
- DCNR Pennsylvania Recreational Trails Program
- DCNR Land and Water Conservation Fund

Below are some of the federal programs that may provide financial support for mitigation activities:

- FEMA Community Assistance Program – State Support Services Element (CAP-SSSE)
- FEMA Community Disaster Loan Program
- FEMA Community Rating System
- FEMA Emergency Management Performance Grants (EMPG)
- FEMA Environmental Planning and Historic Preservation Program (EHP)
- FEMA Flood Mitigation Assistance Program
- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Individuals and Households Program (IHAP)
- FEMA National Dam Safety Program

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- FEMA National Flood Insurance Program
- FEMA Pre-Disaster Mitigation Program
- FEMA Public Assistance Program (PA)
- FEMA Regional Catastrophic Preparedness Grant Program
- FEMA Repetitive Flood Claims Program (RFC)
- FEMA Severe Repetitive Loss Grant Program
- USACE Continuing Authorities Program
- USACE Flood Plain Management Services Program (FPMS)
- USACE Inspection of Completed Works Program (ICW)
- USACE National Levee Safety Program
- USACE Planning Assistance to States
- USACE Rehabilitation and Inspection Program (RIP)

Capital Improvement Financing

Because most of the 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 are always priorities.

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 recreational facilities. Voter approval for this 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.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Authorities are governed by authority board members, who are appointed by the elected officials of the member municipalities.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Sewer Authorities

Sewer authorities include multi-purpose authorities with sewer projects. They sell bonds to finance acquisition of existing systems 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 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 one of the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities 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.

U.S. Department of Agriculture Circuit Riding Program (Engineer)

The Circuit Riding Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join 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

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.

The Monroe County Office of Emergency Management directly interfaced with the public through 2024 at multiple events to ensure that the public was involved in the hazard mitigation

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

planning process. The Monroe County OEM interfaced with members of the public at Public Safety Day in Monroe County and also was present at multiple county events during the summer months. Significant outreach occurred at the annual West End Fair held in Gilbert, Pennsylvania. During this time, the Monroe County OEM solicited hazard information from the public which guided municipalities in determining where project opportunities could occur. This led to a mapping effort which can be found in an additional appendix of this hazard mitigation plan.

Education activities that directly impact hazard mitigation in Monroe County predominantly revolve around the first responders. Providing fire, medical, search and rescue training, and education enhances the response and recovery capabilities of response agencies in the county. Newly appointed emergency management coordinators are trained in both Duties and Responsibilities and damage assessment – which includes a discussion on mitigation; this training can be translated into teaching municipal employees or local emergency services to assist them during a disaster. The Monroe County Office of Emergency Management participates in fire department open houses across the county.

The county also has several websites and social media accounts that can educate residents about hazard mitigation and risk while also communicating information in the event of a disaster:

Monroe County Office of Emergency Management Website:

<https://www.monroecountypa.gov/departments/office-of-emergency-management>

Monroe County Office of Emergency Management Facebook Page:

https://www.facebook.com/MCPAoem/?ref=embed_page

The Monroe County Planning Commission website has an education and outreach capability which could be updated to include hazard mitigation data. The websites of the Monroe County Office of Emergency Management and the Monroe County Planning Commission also post information to educate residents, particularly in disaster preparedness, floodplain management, and zoning requirements. The Monroe County Planning Commission currently provides access to planning documents and educational brochures about the benefits of planning and helpful guides. The Office of Emergency Management also holds quarterly Local Emergency Planning Committee (LEPC) meetings that are open to the public, which serve as another means to conduct outreach and educate the public about hazard mitigation.

Education and outreach on the NFIP are necessary. With new regulations in flood-plain 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

5.2.5. Plan Integration

Plan integration recognizes that hazard mitigation is most effective when it works in efficient coordination with other plans, regulations, and programs. Plan integration promotes safe, resilient growth, effective management, an overall reduction of risk, by ensuring that the goals and actions established in the Hazard Mitigation Plan are included in the comprehensive planning efforts so they can affect future land use and development. Some of the most important areas of planning and regulatory capabilities which hazard mitigation goals and actions should be integrated include comprehensive plans, the hazard mitigation plans from all surrounding or encompassing areas, EOPs, building codes, floodplain ordinances, subdivision, land development ordinances, stormwater management plans and ordinances, and zoning ordinances. All of these tools provide mechanisms for the implementation of adopted mitigation strategies.

Monroe County Comprehensive Plan

Overview

Comprehensive plans establish the overall vision, goals, and objectives for a community's growth. The Monroe County Comprehensive Plan Update was adopted by the Monroe County Commissioners in December of 2014. The plan establishes countywide goals and objectives, describes environmental and demographic characteristics, identifies potential capital improvement projects, and inventories existing planning initiatives and tools in the county.

As part of the update process, the goals and objectives in the 2014 comprehensive plan were reviewed, and those that are currently supportive of hazard mitigation goals and principles were identified.

Recommendations for Continued and Future Integration

As discussed, many of the goals and objectives outlined in the Monroe County Comprehensive Plan are related to the hazard mitigation risks and goals established in the HMP. Several could be revised to include updated information from this HMP. Additionally, the comprehensive plan can identify the places of higher vulnerability that are identified in this plan for all the high-risk hazards, and include objectives aimed at reducing the risk to these vulnerable areas. For example, an objective of the comprehensive plan could be to encourage elevation and flood proofing of structures in the Special Flood Hazard Area (SFHA) by seeking Flood Mitigation Assistance (FMA) grants and strictly enforcing floodplain management ordinances in certain communities (See Section 4.3.3 for Flooding and Flash Flooding information). Similarly, an objective for communities that are most vulnerable to subsidence and land failure could be to educate property owners about mine subsidence, associated risks, and actions to take in the event

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

of an emergency. These types of objectives could also be created for medium-risk hazards when appropriate.

Another key opportunity for further integration of hazard mitigation into planning and regulatory tools is to incorporate hazard mitigation goals and objectives into the future Monroe County Comprehensive Plan update. The Monroe County Comprehensive Plan also ties into the Monroe County Hazard Mitigation Plan when mitigation strategy is considered. The mitigation principles outlined in this hazard mitigation plan are used and reviewed in long-range planning throughout Monroe County.

Integration of Hazard Mitigation into Local Mechanisms

Integration of hazard mitigation principles into local mechanisms can be efficient for Monroe County. With twenty municipalities, local mitigation mechanisms can directly interface with the Monroe County HMP. These potential integration items include municipal comprehensive plans, municipal flood plans, or development plans for transportation and community resources. The municipalities should review the completed HMP and utilize items identified in the risk assessment, mitigation strategy, and capability assessment sections. Previously, hazard mitigation information from the Monroe County plans has been integrated into other planning mechanisms. All municipalities can also utilize portions of the hazard mitigation plan into their planning mechanisms, but this can be completed under the authority of Monroe County. These planning mechanisms could include comprehensive plans, flood plans, or development plans for transportation. Previous successful mitigation and plan integration has occurred in the development of comprehensive plans at the local level and this information and integration should continue through the formal update process of all plans in Monroe County.

Further discussion on plan integration can be found in section 7.3 of this hazard mitigation plan.

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 seven goals, and twenty-four objectives identified in the 2021 hazard mitigation plan. The 2025 Monroe County Hazard Mitigation Plan Update has eight goals and twenty-five objectives. Objectives have been added and arranged to associate them with the most appropriate goal. These changes are noted in *Table 73 – 2021 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 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 fifty-six actions identified in the 2021 mitigation strategy. A review of the 2021 mitigation actions was completed by the local planning team. The results of this review are identified in *Table 74 – 2021 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Table 73 - 2021 Mitigation Goals and Objectives Review

Monroe County 2021 Mitigation Goals and Objectives		
Goal/Objective	Description	Comment
Goal 1	Reduce potential injury, death, and damage to existing community assets due to natural hazards, especially flooding.	2025 Comment: No comment.
Objective 1.1	Continue to use stormwater management planning to reduce flood losses.	2025 Comment: No comment.
Objective 1.2	Recommend that flood insurance policies remain affordable through government programs, especially through the NFIP's CRS.	2025 Comment: Update verbiage: "National Flood Insurance Program," "Community Rating System"
Objective 1.3	Ensure adequate and consistent enforcement of ordinances and codes within and between jurisdictions.	2025 Comment: No comment.
Goal 2	Reduce the potential impact and losses stemming from natural and human-caused disasters on public and private property.	2025 Comment: Update verbiage: "natural and human-caused hazards"
Objective 2.1	Reduce wildfire potential through planning and outreach.	2025 Comment: Update verbiage: "Reduce wildfire vulnerability through planning, outreach, and resource allocation."
Objective 2.2	Ensure that existing streams and drainage systems are engineered and maintained properly when funding and technical assistance is available.	2025 Comment: No comment.
Objective 2.3	Complete actions and projects to acquire, elevate, demolish, or demolish/reconstruct repetitive loss properties.	2025 Comment: Update verbiage: "repetitive loss properties or other vulnerable locations. "
Objective 2.4	Develop and maintain GIS data that supports hazard mitigation planning.	2025 Comment: No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2021 Mitigation Goals and Objectives		
Goal/Objective	Description	Comment
Objective 2.5	Encourage and facilitate the development of continuity planning to reduce the impact of natural and human-caused hazards.	2025 Comment: No comment.
Objective 2.6	Support and enhance broadband and cellular services to unserved areas.	2025 Comment: Relocate to a new goal that will cover social equity, unserved, underserved, and socially vulnerable populations.
Objective 2.7	Provide education programs to public and private property owners and business owners.	2025 Comment: Update verbiage: “Provide education programs to public and private property owners, business owners, and residents in Monroe County. ”
Objective 2.8	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.	2025 Comment: No comment.
Goal 3	Increase public education awareness regarding natural and human-caused hazards, risks, vulnerabilities, preparedness, and mitigation.	2025 Comment: No comment.
Objective 3.1	Support public education programs for business, household and individual mitigation, safety measures and preparedness.	2025 Comment: New verbiage: “ Support public education programs for businesses, households, and individuals including mitigation, safety measures, and preparedness. ”
Objective 3.2	Advise the public on small-scale preservation and conservation measures.	2025 Comment: No comment.
Objective 3.3	Collaborate with partnering agencies to promote awareness of natural and human-caused hazards.	2025 Comment: No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2021 Mitigation Goals and Objectives		
Goal/Objective	Description	Comment
Goal 4	Improve emergency preparedness, warning and response procedures and capabilities.	2025 Comment: No comment.
Objective 4.1	Maintain, upgrade, and provide necessary training on emergency services equipment.	2025 Comment: No comment.
Objective 4.2	Provide residents with adequate warning of potential floods and other weather-related events.	2025 Comment: New verbiage: “Provide residents with adequate warning of potential floods and other weather-related events when possible. ”
Objective 4.3	Ensure adequacy and maintain plans, equipment, and technology.	2025 Comment: No comment.
Goal 5	Reduce or redirect the impact of all hazards away from at-risk, environmental, and urbanized areas.	2025 Comment: No comment.
Objective 5.1	Research possible structural mitigation projects to redirect or reduce the impact of disasters.	2025 Comment: No comment.
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.	2025 Comment: No comment.
Objective 5.3	Research and identify funding sources to decrease the impact of all-hazards in Monroe County.	2025 Comment: No comment.
Goal 6	Reduce the potential impact and losses stemming from technological disasters on public and private property.	2025 Comment: Update verbiage: “human-caused hazards”
Objective 6.1	Provide education programs to public and private property owners and business owners.	2025 Comment: Update verbiage: “on human-caused hazards.”

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2021 Mitigation Goals and Objectives		
Goal/Objective	Description	Comment
Objective 6.2	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.	2025 Comment: Update verbiage: “on human-caused hazards.”
Goal 7	Participate in FEMA’s High-Hazard Potential Dam Program (HHPD).	2025 Comment: No comment.
Objective 7.1	Educate Monroe County municipalities, property owners, and businesses about FEMA’s HHPD program.	2025 Comment: No comment.
Objective 7.2	Reduce long-term vulnerabilities from eligible high-hazard potential dams that pose an unacceptable risk to the public.	2025 Comment: No comment.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 74 - 2021 Mitigation Actions Review

Monroe County Mitigation Actions Review Worksheet						
Existing Mitigation Actions <i>(2021 HMP)</i>	Status					Review Comments
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
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 conduct outreach.			X			2025 Review Comment: 1.1.1 No comment.
1.2.1 Encourage participation in the NFIP-CRS program through outreach and education to municipal officials			X			2025 Review Comment: 1.2.1 “National Flood Insurance Program (NFIP)” and “Community Rating System”
1.2.2 Develop CRS information sheet based on the CRS pointing system to assist municipalities in obtaining CRS certification.			X			2025 Review Comment: 1.2.2 “Community Rating System”
1.3.1 Enforce and update the municipal floodplain ordinances to reduce the impact of flooding.			X			2025 Review Comment: 1.3.1 No comment.
2.1.1 Develop a work group to investigate the initiation of a Firewise program			X			2025 Review Comment: 2.1.1 No comment.
2.1.2 Encourage wildfire-prone municipalities to implement outdoor burning bans, providing ordinance-writing assistance where necessary			X			2025 Review Comment: 2.1.2 “....and provide ordinance-writing assistance where necessary.”

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
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			2025 Review Comment: 2.1.3 No comment.
2.2.1 Address drainage problems as identified in Brodhead/McMichaels and Tobyhanna Creek Watershed Act 167 Plans			X			2025 Review Comment: 2.2.1 No comment.
2.2.2 Remove brush and debris in waterways in identified locations and jurisdictions to alleviate flooding			X			2025 Review Comment: 2.2.2 No comment.
2.2.3 Develop a workgroup with the Conservation District to discuss and investigate the permitting process for debris removal in at-risk waterways			X			2025 Review Comment: 2.2.3 Discuss and investigate the permitting process for debris removal in at-risk waterways as needed.
2.2.4 Conduct regular maintenance on stormwater management structures in compliance with MS4 guidelines. Encourage regular maintenance on stormwater management structures and replace, as needed.			X			2025 Review Comment: 2.2.4 No comment.
2.2.5 Encourage non-MS4 communities to perform regular maintenance on stormwater management structures and replace them, as needed.			X			2025 Review Comment: 2.2.5 No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
2.3.1 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.			X			2025 Review Comment: 2.3.1 No comment.
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			2025 Review Comment: 2.3.2 “.... especially historical properties, community lifelines, critical infrastructure, repetitive loss, and severe repetitive loss properties.”
2.4.1 Develop additional and maintain current GIS layers for critical facilities and infrastructure			X			2025 Review Comment: 2.4.1 Add community lifelines
2.4.2 Develop additional GIS layers for public utility services			X			2025 Review Comment: 2.4.2 No comment.
2.5.1 Conduct emergency planning for transportation routes to reduce business interruption from transportation accidents			X			2025 Review Comment: 2.5.1 No comment.
2.5.2 Develop and implement an Emergency Action Plan for the East Stroudsburg/Stroudsburg Joint Flood Control Project			X			2025 Review Comment: 2.5.2 No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
2.5.3 Encourage non-Storm Ready municipalities to obtain designation.			X			2025 Review Comment: 2.5.3 No comment.
2.5.4 Continue the activities to maintain “Storm Ready” designation			X			2025 Review Comment: 2.5.4 No comment.
2.5.5 Establish a hazard mitigation workgroup that includes utility providers to investigate ways to decrease utility outages			X			2025 Review Comment: 2.5.5 “Encourage utility provider participation in the hazard mitigation planning team to investigate ways to decrease utility outages.”
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			2025 Review Comment: 3.1.1 No comment.
3.1.2 Continue environmental education center programs for school students			X			2025 Review Comment: 3.1.2 No comment.
3.1.3 Continue to provide public outreach on drowning hazards.			X			2025 Review Comment: 3.1.3 No comment.
3.1.4 Educate community groups, employers, people at high-risk for an overdose, and persons in contact with high risk individuals about substance use disorder and treatment and recovery options.			X			2025 Review Comment: 3.1.4 No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
3.2.1 Expand public education programs for homeowner conservation measures to address drought events.			X			2025 Review Comment: 3.2.1 No comment.
3.3.1 Collaborate with Penn State Cooperative Extension, PA Department of Agriculture to promote and educate Monroe County residents about the impacts of invasive species.			X			2025 Review Comment: 3.3.1 No comment.
3.3.2 Create a multi-disciplinary health task force to respond to future pandemic events.			X			2025 Review Comment: 3.3.2 No comment.
3.3.3 Continue to promote and raise awareness of the Monroe County Opioid Task Force to further enhance mitigation efforts.			X			2025 Review Comment: 3.3.3 No comment.
4.1.1 Identify emergency response equipment and training that is needed by first responders concerning hazardous material incidents.			X			2025 Review Comment: 4.1.1 No comment.
4.1.2 Conduct primary road commodity flow study in Monroe County.			X			2025 Review Comment: 4.1.2 “Conduct a primary road commodity flow study in Monroe County.”

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
4.1.3 Conduct secondary road commodity flow study in Monroe County.		X				2025 Review Comment: 4.1.X “Conduct a secondary road commodity flow study in Monroe County.” Remove this action.
4.1.4 Identify emergency generator capabilities for critical facilities in Monroe County.			X			2025 Review Comment: 4.1.3 “... for critical facilities and community lifelines in Monroe County.”
4.1.5 Install emergency generators at critical facilities and other essential facilities to enhance capabilities during utility outages			X			2025 Review Comment: 4.1.4 “Community lifelines” County generator trailer.
4.1.6 Develop a multi-hazard drone emergency response team.			X			2025 Review Comment: 4.1.5 No comment.
4.1.7 Promote the utilization of new technology such as the use of drones to support emergency responders.			X			2025 Review Comment: 4.1.6 No comment.
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			2025 Review Comment: 4.2.1 OEM integrating with the county notification system and sharing with municipalities
4.2.2 Develop a county wide notification and early warning plans for vulnerable populations in Monroe County			X			2025 Review Comment: 4.2.2 “..... socially vulnerable populations.”

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	<i>No Progress/ Unknown</i>	<i>In Progress/Not Yet Complete</i>	<i>Continuous</i>	<i>Completed</i>	<i>Discontinued</i>	
4.3.1 Evaluate current network for cyber security threats.			X			2025 Review Comment: 4.3.1 No comment.
4.3.2 Provide education material to the public regarding the risks of cyber-crimes.			X			2025 Review Comment: 4.3.2 No comment.
4.3.3 Continue to promote retention and recruitment efforts within municipal emergency services.			X			2025 Review Comment: 4.3.3 No comment.
4.3.4 Coordinate outreach with education providers to enhance retention and recruitment of emergency services.			X			2025 Review Comment: 4.3.4 No comment.
5.1.1 Maintain, repair, and/or replace roadway drainage systems at identified locations to alleviate flooding/flash flooding and prevent transportation incidents.			X			2025 Review Comment: 5.1.1 No comment.
5.1.2 Maintain and/or reconstruct identified bridges to prevent transportation accidents and improve the transportation network			X			2025 Review Comment: 5.1.2 No comment.
5.2.1 Encourage municipalities to enforce UCC and promote the establishment of best practices on implementation.			X			2025 Review Comment: 5.2.1 No comment.
5.2.2 Integrate the 2021 Monroe County hazard mitigation plan with other county plans.			X			2025 Review Comment: 5.2.2 2025

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	<i>No Progress/ Unknown</i>	<i>In Progress/Not Yet Complete</i>	<i>Continuous</i>	<i>Completed</i>	<i>Discontinued</i>	
5.3.1 Explore funding opportunities for first responders through the Assistance to Firefighters Grant (AFG).			X			2025 Review Comment: 5.3.1 No comment.
6.1.1 Continue to address a list of problem potholes within the county and submit to PennDOT and appropriate municipalities.			X			2025 Review Comment: 6.1.1 Continue to address a list of problem road issues and potholes within the county....
6.2.1 Maintain Route 611 transportation planning work group to conduct planning for transportation items related to major interstate shutdowns.			X			2025 Review Comment: 6.2.1 No comment.
6.2.3 Maintain a transportation planning work group to conduct planning for transportation items related to major highway shutdowns.			X			2025 Review Comment: 6.2.2 No comment.
7.1.1 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.			X			2025 Review Comment: 8.1.1 No comment.
7.1.2 Distribute educational pamphlets about the HHPD program.			X			2025 Review Comment: 8.1.2 No comment.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County Mitigation Actions Review Worksheet						
<i>Existing Mitigation Actions (2021 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
7.1.3 Utilize all municipal social media pages to disseminate important information regarding the HHPD program to Monroe County residents.			X			2025 Review Comment: 8.1.3 No comment.
7.2.1 Incorporate existing plans, studies, reports, and technical information for eligible high-hazard potential dams.			X			2025 Review Comment: 8.2.1 No comment.
7.2.2 Enhance local mitigation policies and programs that address high-hazard potential dams.			X			2025 Review Comment: 8.2.2 No comment.
7.2.3 Secure funding to reduce vulnerability of HHPD.			X			2025 Review Comment: 8.2.3 No comment.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

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 eight goals and twenty-five corresponding objectives were developed. *Table 75 – 2025 Goals and Objectives* details the mitigation goals and objectives established for the 2025 Monroe County Hazard Mitigation Plan.

Table 75 - 2025 Goals and Objectives

Monroe County 2025 Goals and Objective	
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 National Flood Insurance Program's (NFIP) Community Rating System (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 hazards on public and private property
Objective 2.1	Reduce wildfire vulnerability through planning, outreach, and resource allocation.
Objective 2.2	Ensure that existing streams and drainage systems are engineered and maintained properly.
Objective 2.3	Complete actions and projects to acquire, elevate, demolish, or demolish/reconstruct repetitive loss properties or other vulnerable locations.
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	Provide technical assistance programs to public and private property owners, business owners, community lifelines, and residents.
Objective 2.7	Disseminate information to the private and public sectors on hazard specific plans, response procedures and post disaster restoration plans.

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Goals and Objective	
Goal/Objective	Description
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 businesses, households, and individuals including 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 and community lifelines 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 when possible.
Objective 4.3	Ensure adequacy and maintenance of plans, equipment, and technology.
Goal 5	Reduce or redirect the impact of all hazards away from socially vulnerable or underserved areas, including environmental and urbanized areas.
Objective 5.1	Research possible structural mitigation projects to redirect or reduce the impact of hazards.
Objective 5.2	Encourage and facilitate the development of comprehensive plans, zoning ordinances, land use ordinances, and floodplain management ordinances to appropriately direct development away from all hazard areas.
Objective 5.3	Research and identify funding sources to decrease the impact of all-hazards.
Goal 6	Reduce the potential impact and losses stemming from human-caused hazards on public and private property.
Objective 6.1	Provide education programs to public and private property owners and business owners on human-caused hazards.
Objective 6.2	Disseminate information to the public and private sectors on hazard specific plans, response procedures, and post-disaster restoration plans on human-caused hazards.

Monroe County, Pennsylvania *2025 Hazard Mitigation Plan*

Monroe County 2025 Goals and Objective	
Goal/Objective	Description
Goal 7	Review hazard mitigation mechanisms and projects to assist socially vulnerable and underserved populations.
Objective 7.1	Support and enhance broadband and cellular services to unserved areas.
Goal 8	Participate in FEMA’s High-Hazard Potential Dam Program (HHPD).
Objective 8.1	Educate Monroe County municipalities, property owners, and businesses about FEMA’s HHPD program.
Objective 8.2	Reduce long-term vulnerabilities from eligible high-hazard potential dams that pose an unacceptable risk to the public.
Objective 8.3	Identify, by area, locations that could be potentially impacted by FEMA’s HHPD program.

Goal 8 and objective 8.1, objective 8.2, and objective 8.3 relate to multiple mitigation actions in *Table 77 – 2025 Mitigation Action Plan*. Action 8.1.1, 8.1.2, and 8.1.3 relate to objective 8.1, action 8.2.1, 8.2.2, 8.2.3 relates to objective 8.2, and action 8.3.1 relates to objective 8.3 for HHPD. All seven of the mitigation actions are covered by Goal 8 of the goals and objectives for the 2025 Hazard Mitigation Plan. These mitigations reduce the vulnerability of county populations and structures by educating the public on the HHPD program, enhancing local policies and procedures for HHPD planning, and digitizing dam inundation areas for future analysis and prevention of losses.

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 reduce 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- 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 structure 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 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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 (if applicable)

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 impacts of hazards.

Table 76 – 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 77 – 2025 Mitigation Action Plan*.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 76 - Mitigation Strategy Technique Matrix

Monroe County Mitigation Strategy Technique Matrix				
Hazard	MITIGATION TECHNIQUE			
	Planning and Regulations	Structure and Infrastructure	Natural Systems Protection	Education and Awareness
Drought	X			X
Extreme Temperatures	X			X
Flood, Flash Flood, Ice Jam	X	X	X	X
Hurricane and Tropical Storms	X			X
Invasive Species	X			X
Pandemic, Epidemic, Endemic, and Infectious Disease	X			X
Tornado and Windstorm	X			X
Wildfire	X			X
Winter Storm	X			X
Dam Failure	X			X
Disorientation	X			X
Drowning	X			X
Environmental Hazards	X	X		X
Nuclear Incidents	X			X
Substance Use Disorder	X			X
Terrorism and Cyberterrorism	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 2025 hazard mitigation plan (HMP) update after the risk assessment section was completed. The LPT started this section by reviewing the 2021 HMP mitigation strategy section. A review of the previous goals, objectives, actions, and project opportunities documented in the 2021 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 or in-person meetings. 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 attend conference calls were contacted individually.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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 2025 Monroe County HMP are listed in the mitigation action plan. *Table 77 – 2025 Mitigation Action Plan* is the 2025 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 in Appendix H. *Table 77 – 2025 Mitigation Action Plan* is a matrix that identifies the county and/or municipalities responsible for mitigation actions in the new mitigation action plan. *Table 78 – Municipal Hazard Mitigation Actions Checklist* shows which actions tie to specific municipalities for responsibilities. *Table 79 – Objective to Action Checklist* shows that each mitigation objective has a mitigation action item related to it. *Table 80 – Actions Tied to Hazards* illustrates the specific actions that are tied to each hazard outlined in the hazard mitigation plan.

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

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

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

Evaluate and Prioritize Mitigation Actions

Mitigation Action Evaluation:

Evaluating mitigation actions involves judging each action against certain criteria to determine whether it can be executed. The feasibility of each mitigation action is evaluated using the ten evaluation criteria set forth in the Mitigation Action Evaluation methodology as outlined in the Commonwealth of Pennsylvania's All-Hazard Mitigation Planning, Standard Operating Guide. The methodology solicits input on whether each action is highly effective or feasible and ineffective or not feasible for the criteria. These criteria are listed below and aid in determining the feasibility of implementing one action over another.

- Life Safety: Will the action be effective in promoting public safety?
- Property Protection: Will the action be effective in protecting public or private property?
- Technical: How effective will the action be in avoiding or reducing future losses?
- Political: Does the action have public and political support?
- Legal: Does the community have the authority to implement the proposed measure?
- Environmental: Will the action provide environmental benefits, and will it comply with local, state, and federal environmental regulations?
- Social: Will the action be acceptable by the community, or will it cause any one segment of the population to be treated unfairly?
- Administrative: Is there adequate staffing and funding available to implement the action in a timely manner?
- Local Champion: Is there local support for the action to help ensure its completion?
- Other Community Objectives: Does the action address any current or future community objectives either through municipal planning or community goals?

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

To evaluate the mitigation actions, each action is identified as highly effective or feasible, ineffective, or not favorable and has no cost or benefit. For each criterion, the prioritization methodology assigns a “+” if the action is highly effective or feasible, a “-“ if the action was ineffective or not feasible, and a “N” if no cost of benefit could be associated with the suggested action or the action was no applicable to the criteria.

Mitigation Action Prioritization:

Actions should be compared with one another to determine a ranking or priority by applying the multi-objective mitigation action prioritization criteria. Scores are assigned to each criterion using the following weighted, multi-objective mitigation action prioritization criteria:

- Effectiveness (weight: 20% of score): The extent to which an action reduces the vulnerability of people and property.
- Efficiency (weight: 30% of score): The extent to which time, effort, and cost is well used as a means of reducing vulnerability.
- Multi-Hazard Mitigation (weight: 20% of score): The action reduces vulnerability for more than one hazard.
- Address High Risk Hazard (weight: 15% of score): The action reduces vulnerability for people and property from a hazard identified as high risk.
- Address Critical Communications/Critical Infrastructure (weight: 15% of score): The action pertains to the maintenance of critical functions and structures such as transportation, supply chain management, and data circuits, etc.

Scores of 1, 2, or 3 are assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. Actions are prioritized using the cumulative score assigned to each. Each mitigation action is given a priority ranking (Low, Medium, and High) based on the following:

- Low Priority: 1.0 – 1.8
- Medium Priority: 1.9 – 2.4
- High Priority: 2.5 – 3.0

The cumulative results of the prioritization of mitigation actions are identified in the mitigation action evaluation and prioritization tool. The results for the mitigation action evaluation and prioritization are in Appendix H of this plan.

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 77 - 2025 Mitigation Action Plan

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
1.1.1	Planning 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 Ice Jam Flood	Low	2025-2030	Local	Monroe County Conservation District Director
1.2.1	Education and Awareness	Encourage participation in the National Flood Insurance Program's (NFIP) Community Rating System (CRS) program through outreach and education to municipal officials.	Flood Flash Flood Ice Jam Flood	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Planning Commission Director and Planners Monroe County Conservation District Director
1.2.2	Education and Awareness	Develop Community Rating System information sheet based on the CRS pointing system to assist municipalities in obtaining CRS certification.	Flood Flash Flood Ice Jam Flood	Low	2025-2030	Local	Monroe County Planning Commission Director
1.3.1	Planning and Regulations	Enforce and update the municipal floodplain ordinances to reduce the impact of flooding.	Flood Flash Flood Ice Jam Flood	Medium	2025-2030	Local	Monroe County Municipality Representatives

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.1.1	Education and Awareness	Develop a workgroup to investigate the initiation of a Firewise program.	Wildfire	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
2.1.2	Planning and Regulations	Encourage wildfire-prone municipalities to implement outdoor burning bans and provide ordinance-writing assistance where necessary.	Wildfire	High	2025-2030	Local	Monroe County Planning Commission Director Monroe County Municipality Representatives
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	Medium	2025-2030	Local	Monroe County Municipality Emergency Management Coordinators
2.2.1	Structure and Infrastructure	Address drainage problems as identified in Brodhead/McMichaels and Tobyhanna Creek Watershed Act 167 Plans.	Flood Flash Flood Ice Jam Flood	Low	2025-2030	Local	Monroe County Conservation District Director
2.2.2	Natural Systems Protection	Remove brush and debris in waterways in identified locations and jurisdictions to alleviate flooding.	Flood Flash Flood Ice Jam Flood	Medium	2025-2030	Local	Monroe County Township Supervisors

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.2.3	Planning 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 Ice Jam Flood	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
2.2.4	Structure 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 Ice Jam Flood	Medium	2025-2030	Local	Monroe County Municipality Representatives
2.2.5	Structure and Infrastructure	Encourage non-MS4 communities to perform regular maintenance on stormwater management structures and replace as needed.	Flood Flash Flood Ice Jam Flood	Medium	2025-2030	Local	Monroe County Municipality Representatives
2.2.6	Natural System Protections	Secure funding and technical assistance to complete maintenance of existing streams and drainage systems.	Flood	Medium	2025-2030	Local	Monroe County Conservation District Director Monroe County Municipality Representatives

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.3.1	Structure 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 Ice Jam Flood	Medium	2025-2030	HMGP, FMA, BRIC	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
2.3.2	Structure and Infrastructure	Identify the lowest floor elevation of the most vulnerable structures to flooding, especially historical properties, community lifelines, critical infrastructure, repetitive loss, and severe repetitive loss properties.	Flood Flash Flood Ice Jam Flood	Medium	2025-2030	HMGP, FMA, BRIC	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
2.4.1	Planning and Regulations	Develop additional and maintain current GIS layers for critical facilities and infrastructure.	All Hazards	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Planning Commission Director

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.4.2	Planning and Regulations	Develop additional GIS layers for public utility services.	All Hazards	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Planning Commission GIS Analysts
2.5.1	Planning and Regulations	Conduct emergency planning for transportation routes to reduce business interruption from transportation accidents.	Transportation Accidents Hazardous Materials - Transportation	Medium	2025-2030	Local	Monroe County Municipality Representatives
2.5.2	Planning and Regulations	Maintain and update the Emergency Action Plan for the East Stroudsburg/Stroudsburg Joint Flood Control Project.	Flood Flash Flood Ice Jam Flood	Medium	2025-2030	DEP and Local	Stroudsburg and East Stroudsburg Borough Councils and Managers
2.5.3	Education and Awareness	Encourage non-Storm Ready municipalities to obtain designation.	Natural Hazards	High	2025-2030	NOAA	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.5.4	Education and Awareness	Continue the activities to maintain “Storm Ready” designation	Natural Hazards	Medium	2025-2030	NOAA and Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
2.5.5	Planning and Regulations	Encourage utility provider participation in the hazard mitigation planning team to investigate ways to decrease utility outages.	Utility Interruptions	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
2.6.1	Planning and Regulations	Review the current Monroe County technical assistance programs for all hazards that could impact business owners and community lifeline facilities.	All Hazards	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
2.7.1	Planning and Regulations	Continue to provide information to relevant planning partners on other Monroe County planning items that could be integrated into the 5-year update of the hazard mitigation plan.	All Hazards	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Planning Commission Director

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
2.7.2	Planning and Regulations	Continue to make the hazard mitigation, hazard specific plans, response procedures, and post-disaster recovery plans available publicly through the relevant websites.	All Hazards	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Planning Commission Director
2.7.3	Education and Awareness	Conduct outreach and provide education about radon exposure. For example, include information text on municipal websites and county websites about the potential impacts of radon and how to acquire free test kits.	Radon Exposure	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
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	Medium	2025-2030	HMGP and Local	Monroe County Office of Emergency Management Director and Planners
3.1.2	Education and Awareness	Continue environmental education center programs for school students.	All Hazards	High	2025-2030	Local	Monroe County Conservation District Director

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
3.1.3	Education and Awareness	Continue to provide public outreach on drowning hazards.	Drowning	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
3.1.4	Education and Awareness	Educate community groups, employers, people at high-risk for an overdose, and persons in contact with high risk individuals about substance use disorder and treatment and recovery options.	Substance Use Disorder	Medium	2025-2030	Local	Monroe County Opiate Task Force Representatives and Participants
3.2.1	Education and Awareness	Expand public education programs for homeowner conservation measures to address drought events.	Drought	Low	2025-2030	Local	Monroe County Conservation District Director
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	Medium	2025-2030	Local	Monroe County Conservation District Director
3.3.2	Education and Awareness	Create a multi-disciplinary health task force to respond to future pandemic events.	Pandemic and Infectious Disease	Medium	2025-2030	Local	Monroe County Commissioners
3.3.3	Education and Awareness	Continue to promote and raise awareness of the Monroe County Opioid Task Force to further enhance mitigation efforts.	Substance Use Disorder	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
4.1.1	Structure and Infrastructure	Identify emergency response equipment and training that is needed by first responders concerning hazardous material incidents.	Hazardous Materials – Transportation and Fixed Facility	High	2025-2030	LEPC	Monroe County LEPC Members
4.1.2	Planning and Regulations	Conduct a primary road commodity flow study in Monroe County.	Hazardous Materials – Transportation	High	2025-2030	HMEP	Monroe County LEPC Members Monroe County Office of Emergency Management Director and Planners
4.1.3	Structure and Infrastructure	Identify emergency generator capabilities for critical facilities and community lifelines in Monroe County.	Hazardous Materials – Transportation	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners ESU Representatives
4.1.4	Structure and Infrastructure	Install emergency generators at critical facilities and community lifelines to enhance capabilities during utility outages.	Utility Interruptions	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
4.1.5	Planning and Regulations	Develop a multi-hazard drone emergency response team.	All Hazards	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
4.1.6	Education and Awareness	Promote the utilization of new technology such as the use of drones to support emergency responders.	Human-Caused Hazards	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
4.2.1	Planning 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	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Chestnuthill Township Supervisors, Middle Smithfield Township Supervisors ESU Representatives
4.2.2	Planning and Regulations	Develop a county wide notification and early warning plans for socially vulnerable populations in Monroe County.	Flood Flash Flood Ice Jam Flood Hazardous Materials – Transportation and Fixed Facility	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
4.3.1	Education and Awareness	Evaluate current network for cyber security threats.	Cyberterrorism	Medium	2025-2030	Local	Monroe County IT Department Director and Designated Employees

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
4.3.2	Education and Awareness	Provide education material to the public regarding the risks of cyber-crimes.	Cyberterrorism	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
4.3.3	Education and Awareness	Continue to promote retention and recruitment efforts within municipal emergency services.	Emergency Services Shortage	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives
4.3.4	Education and Awareness	Coordinate outreach with education providers to enhance retention and recruitment of emergency services.	Emergency Services Shortage	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Monroe County Municipality Representatives

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
5.1.1	Structure 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 Flood Transportation Accidents Hazardous Material - Transportation	High	2025-2030	Local and HMGP	Monroe County Municipality Representatives
5.1.2	Structure and Infrastructure	Maintain and/or reconstruct identified bridges to prevent transportation accidents and improve the transportation network.	Flood Flash Flood Ice Jam Flood Transportation Accidents Hazardous Material - Transportation	High	2025-2030	PennDOT and Local	Monroe County Municipality Representatives
5.2.1	Planning and Regulations	Encourage municipalities to enforce UCC and promote the establishment of best practices on implementation.	All Hazards	High	2025-2030	Local	Monroe County Planning Commission Director
5.2.2	Planning and Regulations	Integrate the 2025 Monroe County hazard mitigation plan with other county plans.	All Hazards	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
5.3.1	Planning and Regulations	Explore funding opportunities for first responders through the Assistance to Firefighters Grant (AFG).	Emergency Services Shortage	High	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
6.1.1	Education and Awareness	Continue to address a list of problem road issues and potholes within the county and submit to PennDOT or appropriate municipalities.	Transportation Accidents Hazardous Materials - Transportation	Low	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
6.2.1	Planning and Regulations	Maintain Route 611 transportation planning work group to conduct planning for transportation items related to major interstate shutdowns.	Transportation Accidents Hazardous Materials - Transportation	Low	2025-2030		NEPA-MPO Monroe County Municipality Representatives along Route 611
6.2.2	Planning and Regulations	Maintain a transportation planning work group to conduct planning for transportation items related to major highway shutdowns.	Transportation Accidents Hazardous Materials - Transportation	Low	2025-2030	Local	NEPA-MPO Monroe County Municipality Representatives along Route 611
7.1.1	Structure and Infrastructure	Review the broadband and cellular service areas in Monroe County and how those locations overlap with the areas of unserved communities.	Utility Interruptions	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners Montore County Planning Commission Director

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
8.1.1	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	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
8.1.2	Education and Awareness	Distribute educational pamphlets about the HHPD program.	Dam Failure	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
8.1.3	Education and Awareness	Utilize all municipal social media pages to disseminate important information regarding the HHPD program to Monroe County residents.	Dam Failure	Medium	2025-2030	Local	Monroe County Municipality Representatives
8.2.1	Planning and Regulations	Incorporate existing plans, studies, reports, and technical information for eligible high-hazard potential dams.	Dam Failure	Medium	2025-2030	Local	Monroe County Office of Emergency Management Director and Planners
8.2.2	Planning and Regulations	Enhance local mitigation policies and programs that address high-hazard potential dams.	Dam Failure	Medium	2025-2030	HHPD	Monroe County Office of Emergency Management Director and Planners
8.2.3	Planning and Regulations	Secure funding to reduce vulnerability of HHPD.	Dam Failure	Medium	2025-2030	HHPD	Monroe County Office of Emergency Management Director and Planners

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Monroe County 2025 Mitigation Action Plan							
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization	Implementation		
	Category	Description/ Action Items		High/ Medium/ Low	Schedule	Funding	Local Champion
8.3.1	Planning and Regulations	Acquire or maintain digitized dam inundation GIS polygons to determine at risk populations for dams designated high-hazard potential dams by FEMA.	Dam Failure	High	2025-2030	HHPD, Local	Monroe County Planning Commission GIS Analysts

Table 78 - 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	2.2.4
Barrett Township				X		X	X		X	X	X
Chestnuthill Township				X		X	X		X	X	X
Coolbaugh Township				X		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	X
Hamilton Township				X		X	X		X	X	X
Jackson Township				X		X	X		X	X	X
Middle Smithfield Township				X		X	X		X	X	X
Mount Pocono Borough				X		X	X			X	X
Paradise Township				X		X	X		X	X	X
Pocono Township				X		X	X		X	X	X
Polk Township				X		X	X		X	X	X
Price Township				X		X	X		X	X	X
Ross Township				X		X	X		X	X	X
Smithfield Township				X		X	X		X	X	X
Stroud Township				X		X	X		X	X	X
Stroudsburg Borough				X		X	X			X	X
Tobyhanna Township				X		X	X		X	X	X
Tunkhannock Township				X		X	X		X	X	X
Monroe County	X	X	X		X	X		X		X	

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Municipal Hazard Mitigation Actions Checklist											
Municipality	2.2.5	2.2.6	2.3.1	2.3.2	2.4.1	2.4.2	2.5.1	2.5.2	2.5.3	2.5.4	2.5.5
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	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	X
Tobyhanna Township	X	X	X	X			X		X	X	X
Tunkhannock Township	X	X	X	X			X		X	X	X
Monroe County		X	X	X	X	X			X	X	X

Municipal Hazard Mitigation Actions Checklist												
Municipality	2.6.1	2.7.1	2.7.2	2.7.3	3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.3.1	3.3.2	3.3.3
Barrett Township				X								
Chestnuthill Township				X								
Coolbaugh Township				X								
Delaware Water Gap Borough				X								
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								
Polk Township				X								

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Municipal Hazard Mitigation Actions Checklist												
Municipality	2.6.1	2.7.1	2.7.2	2.7.3	3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.3.1	3.3.2	3.3.3
Price Township				X								
Ross Township				X								
Smithfield Township				X								
Stroud Township				X								
Stroudsburg Borough				X								
Tobyhanna Township				X								
Tunkhannock Township				X								
Monroe County	X	X	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist											
Municipality	4.1.1	4.1.2	4.1.3	4.1.4	4.1.5	4.1.6	4.2.1	4.2.2	4.3.1	4.3.2	4.3.3
Barrett Township								X		X	X
Chestnuthill Township							X	X		X	X
Coolbaugh Township								X		X	X
Delaware Water Gap Borough								X		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	X
Mount Pocono Borough								X		X	X
Paradise Township								X		X	X
Pocono Township								X		X	X
Polk Township								X		X	X
Price Township								X		X	X
Ross Township								X		X	X
Smithfield Township								X		X	X
Stroud Township								X		X	X
Stroudsburg Borough								X		X	X
Tobyhanna Township								X		X	X
Tunkhannock Township								X		X	X
Monroe County	X	X	X	X	X	X	X	X	X	X	X

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Municipal Hazard Mitigation Actions Checklist											
Municipality	4.3.4	5.1.1	5.1.2	5.2.1	5.2.2	5.3.1	6.1.1	6.2.1	6.2.2	7.1.1	8.1.1
Barrett Township	X	X	X								
Chestnuthill Township	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								
Eldred Township	X	X	X								
Hamilton Township	X	X	X					X	X		
Jackson Township	X	X	X								
Middle Smithfield Township	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								
Price Township	X	X	X								
Ross Township	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								
Tunkhannock Township	X	X	X								
Monroe County	X			X	X	X	X			X	X

Municipal Hazard Mitigation Actions Checklist											
Municipality	8.1.2	8.1.3	8.2.1	8.2.2	8.2.3	8.3.1					
Barrett Township		X									
Chestnuthill Township		X									
Coolbaugh Township		X									
Delaware Water Gap Borough		X									
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									
Polk Township		X									
Price Township		X									
Ross Township		X									
Smithfield Township		X									
Stroud Township		X									

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Municipal Hazard Mitigation Actions Checklist										
Municipality	8.1.2	8.1.3	8.2.1	8.2.2	8.2.3	8.3.1				
Stroudsburg Borough		X								
Tobyhanna Township		X								
Tunkhannock Township		X								
<i>Monroe County</i>	<i>X</i>		<i>X</i>	<i>X</i>	<i>X</i>	<i>X</i>				

Table 79 - Objective to Action Checklist

Objective	Number of Actions
Objective 1.1	1
Objective 1.2	2
Objective 1.3	1
Objective 2.1	3
Objective 2.2	6
Objective 2.3	2
Objective 2.4	2
Objective 2.5	5
Objective 2.6	1
Objective 2.7	3
Objective 3.1	4
Objective 3.2	1
Objective 3.3	3
Objective 4.1	6
Objective 4.2	2
Objective 4.3	4
Objective 5.1	2
Objective 5.2	2
Objective 5.3	1
Objective 6.1	1
Objective 6.2	2
Objective 7.1	1
Objective 8.1	3
Objective 8.2	3
Objective 8.3	1

Monroe County, Pennsylvania

2025 Hazard Mitigation Plan

Table 80 - Actions Tied to Hazard

Actions Tied to Hazard	
Hazard	Actions Related
Natural Hazards	
Drought	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.2.1, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Extreme Temperatures	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Flood	1.1.1, 1.2.1, 1.2.2, 1.3.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.5.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2
Flash Flooding	1.1.1, 1.2.1, 1.2.2, 1.3.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.5.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2
Ice Jam	1.1.1, 1.2.1, 1.2.2, 1.3.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.5.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2
Hurricane and Tropical Storm	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Invasive Species	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.3.1, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Pandemic, Epidemic, Endemic, and Infectious Disease	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.3.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Tornado and Windstorm	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Wildfire	2.1.1, 2.1.2, 2.1.3, 2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2
Winter Storm	2.4.1, 2.4.2, 2.5.3, 2.5.4, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.2.1, 5.2.1, 5.2.2

***Monroe County, Pennsylvania
2025 Hazard Mitigation Plan***

Actions Tied to Hazard	
Hazard	Actions Related
Human-Caused Hazards	
Dam Failure	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2, 8.1.1, 8.1.2, 8.1.3, 8.2.1, 8.2.2, 8.2.3, 8.3.1
Disorientation	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2
Drowning	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.1.3, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2
Environmental Hazards	2.4.1, 2.4.2, 2.5.1, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.1, 4.1.2, 4.1.3, 4.1.5, 4.1.6, 4.2.1, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.1.1, 6.2.1, 6.2.2
Nuclear Incidents	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2
Substance Use Disorder	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.1.4, 3.3.3, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2
Terrorism and Cyberterrorism	2.4.1, 2.4.2, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.1.6, 4.2.1, 4.3.1, 4.3.2, 5.2.1, 5.2.2
Transportation Accidents	2.4.1, 2.4.2, 2.5.1, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.5, 4.1.6, 4.2.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 6.1.1, 6.2.1, 6.2.2
Utility Interruptions	2.4.1, 2.4.2, 2.5.5, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 4.1.4, 4.1.5, 4.1.6, 4.2.1, 5.2.1, 5.2.2, 7.1.1

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. This HMP update also defines the municipalities' role in updating and evaluating the plan. Finally, the 2025 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 and risk analysis reflect the 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 with the county.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

- Complete a review and update of the capability assessment section. Identify any capability weaknesses since the last review.
- Complete a review of the mitigation strategy section. Review the goals and objectives identified in the 2025 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.

The Monroe County local planning team should also be reviewed annually to address any changes to the membership that may have occurred over the past calendar year. The LPT can be expanded and updated with new stakeholders to address potential changes in guidance by the Commonwealth of Pennsylvania and the Federal Emergency Management Agency.

7.3. Continued Public Involvement

The Monroe County Office of Emergency Management will ensure that the 2025 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: <https://monroecountypa.gov/departments/office-of-emergency-management/resources/hazard-mitigation>

The public will have access to the 2025 Monroe County 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.

Monroe County, Pennsylvania 2025 Hazard Mitigation Plan

Once the Monroe County 2025 Hazard Mitigation Plan is adopted by the Monroe County Board of County Commissioners, the plan will be disseminated to various county agencies and local municipalities that develop and implement specific plans and ordinances. Each participating municipality will be responsible for implementing the specific recommendations in section 5.2.5, plan integration, of the capability assessment into their local planning documents including comprehensive plans, zoning ordinances, land development, and subdivision regulations. Whenever possible, the Monroe County Planning Commission will serve as a liaison to assist with these integrations and updates. As discussed above in section 7.2, progress on multi-jurisdictional plan integration will be addressed as part of the annual review conducted by the Monroe County Local Planning Team.

It is recommended that the Monroe County local planning team and steering committee continue to solicit information on hazard impacts and locations from the public. The outreach portion of the community mapping effort was a significant item for the Monroe County hazard mitigation plan and provided useful information on risk and vulnerability identification.

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 2025 Monroe County Hazard Mitigation Plan. Copies of the adopting resolutions are included in this plan in Appendix J. FEMA Region III in Philadelphia, Pennsylvania 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 Community Lifeline Facilities
APPENDIX F:	2025 HAZUS Reports
APPENDIX G:	2025 Mitigation Project Opportunities
APPENDIX H:	2025 Mitigation Action Evaluation & Prioritization
APPENDIX I:	Annual Review Documentation
APPENDIX J:	Monroe County & Municipal Adoption Resolutions