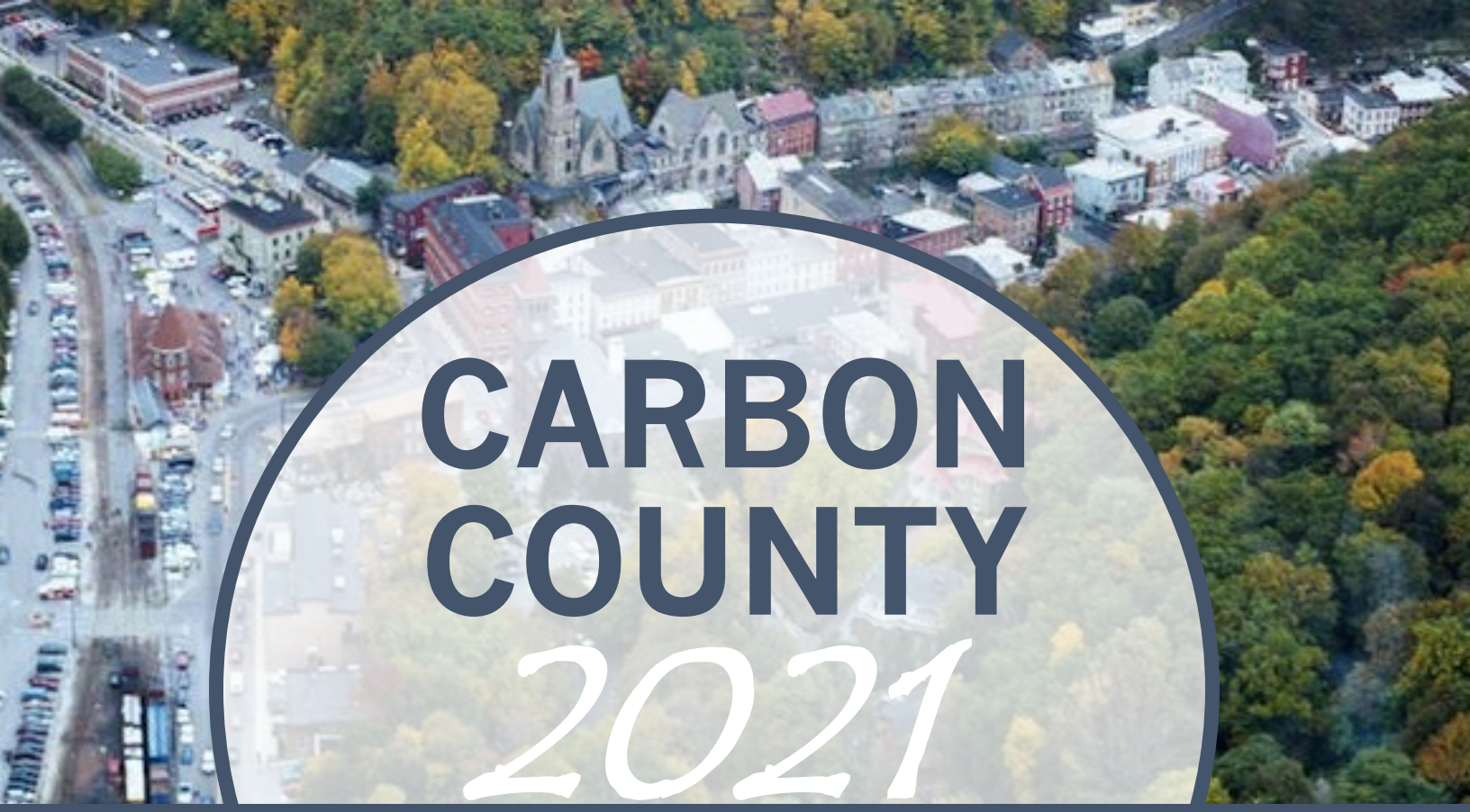

CARBON COUNTY 2021

HAZARD MITIGATION PLAN UPDATE

PREPARED FOR:

Carbon County
Office of Planning & Development
76 Susquehanna Street
Jim Thorpe, PA 18229

PREPARED BY:

Michael Baker International, Inc.
1818 Market Street, Suite 3110
Philadelphia, Pennsylvania 19103

Michael Baker INTERNATIONAL

Certification of Annual Review Meetings

The Carbon County Hazard Mitigation Planning Team (HMPT) has reviewed this Hazard Mitigation Plan. See Section 8 for further details regarding this form. The director of the HMPT hereby certifies the review.

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2015	--		
2016	--		
2017	--		
2018	--		
2019			
2020			
2021			
2022			
2023			

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

Record of Changes

DATE	DESCRIPTION OF CHANGE MADE, MITIGATION ACTION COMPLETED, OR PUBLIC OUTREACH PERFORMED	CHANGE MADE BY (PRINT NAME)	CHANGE MADE BY (SIGNATURE)
2016-2020	To the best knowledge of the Carbon County HMPT, no HMP progress reports were submitted from municipalities for the period from 2016-2020 although some mitigation actions were accomplished in this period. Progress on actions is discussed in detail in Section 6.1 of this plan.	N/A	N/A

REMINDER: Please attach all associated meeting agendas, sign-in sheets, handouts, and minutes.

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**Sensitive Information – Not for public distribution*

Table of Acronyms			
ACRONYM	**FULL NAME**	**ACRONYM**	**FULL NAME**
CFR	Code of Federal Regulations	NFPA	National Fire Protection Association
CRS	Community Ratings System	NHC	National Hurricane Center
DCED	Department of Community and Economic Development	NIDIS	National Integrated Drought Information System
DCNR	Department of Conservation and Natural Resources	NOAA	National Oceanic and Atmospheric Association
DCNR-BOF	Department of Conservation and Natural Resources-Bureau of Forestry	NWS	National Weather Service
DMA	Disaster Mitigation Act	PEIRS	Pennsylvania Emergency Incident Reporting System
EOP	Emergency Operations Plan	PA DEP	Pennsylvania Department of Environmental Protection
EOC	Emergency Operations Center	PaGWIS	Pennsylvania Groundwater Information System
EMC	Emergency Management Coordinator	PASDA	Pennsylvania Spatial Data Access
EPA	Environmental Protection Agency	PDM	Pre-Disaster Mitigation Assistance Program
FEMA	Federal Emergency Management Agency	PDSI	Palmer Drought Severity Index
FIRM	Flood Insurance Rate Map	PEMA	Pennsylvania Emergency Management Agency
FMA	Flood Mitigation Assistance Program	PennDOT	Pennsylvania Department of Transportation
HMGP	Hazard Mitigation Grant Program	RF	Risk Factor
HMPT	Hazard Mitigation Planning Team	SALDO	Subdivision and Land Development Ordinance
HMPU	Hazard Mitigation Plan Update	SFHA	Special Flood Hazard Area
HVA	Hazards Vulnerability Analysis	SOG	Standard Operating Guide

Table of Acronyms			
ACRONYM	**FULL NAME**	**ACRONYM**	**FULL NAME**
ICC	International Code Council	UCC	Universal Construction Code
IBC	International Building Code	US DOT	United States Department of Transportation
NCDC	National Climatic Data Center	USACE	United States Army Corps of Engineers
NDIS	National Drought Information System	USDA	United States Department of Agriculture
NDMC	National Drought Mitigation Center	USGS	United States Geological Survey
NFIP	National Flood Insurance Program	WYO	Write Your Own

1. Introduction

1.1. *Background*

Across the United States, natural and human-caused disasters have led to increasing levels of deaths, injuries, property damage, and interruption of business and government services. The time, money, and efforts to recover from these disasters exhaust resources, diverting attention from important public programs and private agendas. Since 1955 there have been 62 Presidential Disaster and Emergency Declarations in Pennsylvania, 16 of which affected Carbon County. The emergency management community, citizens, elected officials and other stakeholders in Carbon County, Pennsylvania recognize the impact of disasters on their community and support proactive efforts needed to reduce the impact of natural and human-caused hazards.

Hazard Mitigation is defined by the Federal Emergency Management Agency (FEMA) as "sustained action taken to reduce or eliminate long-term risk to people and property from hazards and their effects". The hazard mitigation planning process involves the coordination of actions taken to reduce injuries, deaths, property damage, economic losses, and degradation of natural resources caused by natural and man-made disasters. Hazard mitigation is considered one of four phases in the emergency management cycle. Others include emergency preparedness, emergency response, and recovery.

- Hazard mitigation activities involve actions that reduce or eliminate the probability of an occurrence or reduce the impact of a disaster. The goal of the mitigation phase is to make communities more resistant to disasters and thereby decrease the need for a response. Mitigation occurs long before a disaster.
- Preparedness activities include planning and preparing for when a disaster strikes and includes response capability actions to ensure an effective and efficient use of resources and efforts to minimize damage. Preparedness occurs just before a disaster.
- Emergency response activities include providing emergency assistance to victims and minimizing property loss. The response phase begins during or immediately after the onset of a disaster.
- Recovery activities include short and long-term activities that help return individuals and communities to normalcy as soon as possible. Recovery actions involve clean-up efforts, temporary housing, and replacement

THE CARBON COUNTY HAZARD MITIGATION PLAN IS THE RESULT OF WORK BY CITIZENS OF THE COUNTY TO DEVELOP A PRE-DISASTER, MULTI-HAZARD MITIGATION PLAN THAT WILL NOT ONLY GUIDE THE COUNTY TOWARDS GREATER DISASTER RESISTANCE, BUT WILL ALSO RESPECT THE CHARACTER AND NEEDS OF THE COMMUNITY.

of infrastructure. Recovery activities typically commence several days or weeks after a disaster and are long-term.

2015 Hazard Mitigation Plan

The initial Hazard Mitigation Plan (HMP) for Carbon County was completed in 2015. This effort was led by the Carbon County Emergency Management Agency and the Office of Planning and Development. A total of 16 of Carbon County's 23 municipalities participated in the planning process via questionnaires, meetings and identification of mitigation projects. The 2015 Plan identified the County as being susceptible to a range of natural hazards including floods, drought, landslide, winter storms, dam failure, drowning, utility interruption, and others.

2021 Plan Update

The 2021 Plan Update is intended to enable the County and its municipalities to effectively reduce the potential risks of identified hazards to the health, safety and property of the residents. The Plan Update will also allow Carbon County municipalities to be eligible for a range of financial assistance following hazard events.

The 2021 Plan Update consists of a thorough review and evaluation of the 2015 Plan. Each chapter in the 2021 HMP has been updated as necessary. A summary is included at the beginning of each chapter to indicate how this Plan was updated from the 2015 version. The Plan Update involves the review of data on potential hazards and reprioritization of these hazards in terms of frequency and severity. The Plan Update includes a review of mitigation actions, which were revised, deleted, or modified to address the high priority hazards as well as a Plan Maintenance section that describes how the Plan will be updated and maintained during the next five-year cycle.

The 2021 Hazard Mitigation Plan Update comprises eight chapters. Chapter 1 includes the prerequisites of the Plan. Chapter 2 introduces the plan update process and includes an overview of the socio-economic and demographic characteristics. Chapter 3 discusses the planning process. Chapter 4 comprises the hazard identification and risk assessment and examines vulnerability and the potential losses from the top priority hazards. Chapter 4 also includes a historic profile of hazard types and associated losses, and a vulnerability assessment, which analyzes the potential for future damages due to the hazards identified. Chapter 5 contains a capability assessment including a review of existing plans and ordinances from the counties and municipalities. Chapter 6 discusses the mitigation strategy including updated mitigation goals and objectives, mitigation actions, and the method for prioritization and implementation of mitigation actions. Chapter 7 outlines how Carbon County and its municipalities will implement the Plan once it is adopted and ways to monitor progress and ensure continued public involvement. Chapter 8 includes letters of adoption by the County Commission and the individual municipalities

1.2. *Purpose*

This plan was developed for the purpose of:

- Providing a blueprint for reducing property damage and saving lives from the effects of future natural and human-made hazards in Carbon County;
- Complying with state and federal legislative requirements for County mitigation in order for the County to be eligible for federal and technical assistance from State and Federal hazard mitigation programs;

- Identifying, introducing, and implementing cost-effective hazard mitigation measures in order to accomplish County goals and objectives and to raise awareness and acceptance of hazard mitigation; and
- Improving community resiliency following a disaster event.

Adoption of this plan ensures that Carbon County and participating jurisdictions continue to be eligible to apply for and receive certain federal grant funds that are administered by the Commonwealth of Pennsylvania for FEMA. This plan complies with the requirements of the Disaster Mitigation Act of 2000 and its implementing regulations published in Title 44 of the Code of Federal Regulations (CFR) Section 201.6.

1.3. *Scope*

In August of 2020, Carbon County contracted with Michael Baker International, Inc. to support HMP Update development in compliance with the requirements of the Disaster Mitigation Act of 2000. The HMP Update was funded by Hazard Mitigation Assistance (HMA) funds from FEMA and administered by the Pennsylvania Emergency Management Agency (PEMA). The Plan Update is a multi- jurisdictional plan that covers Carbon County and its 23 municipalities.

It should be noted that future funding for mitigation projects will be contingent upon having each jurisdiction in Carbon County adopt the plan after the County adopts the Update. Any jurisdiction that does not adopt the 2021 Plan Update will become ineligible for pre- and post-disaster mitigation funds.

The Carbon County 2021 Hazard Mitigation Plan Update has been prepared to meet requirements set forth by FEMA and PEMA in order for the County to be eligible for funding and technical assistance from state and federal hazard mitigation programs. It will be updated and maintained to continually address hazards determined to be of significant risk to the County and/or its local municipalities. Review will take place annually and following significant disasters, and a full Plan Update will occur, as required, every five years.

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;
- CFR, Title 44, Parts 201 and 206;
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended; and
- 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; and
- Pennsylvania Stormwater Management Act of October 4, 1978. P.L. 864, No. 167.

The following 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 Mitigation Planning Handbook.* March 2013.
- FEMA: *Local Mitigation Plan Review Guide.* October 2011.
- FEMA: *National Fire Incident Reporting System 5.0: Complete Reference Guide*. January 2008.
- FEMA: *Hazard Mitigation Assistance Unified Guidance*. February 2015.
- FEMA: *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. March 2013
- FEMA: *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.* January 2013.

The following Pennsylvania Emergency Management Agency (PEMA) guides and reference documents were used 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 2009.
- PEMA: *Pennsylvania's Hazard Mitigation Planning Standard Operating Guide*. October 2020.

The following additional guidance document produced by the National Fire Protection Association (NFPA) was used to update this plan:

- NFPA 1600: *Standard on Disaster/Emergency Management and Business Continuity Programs*. 2007.

2. Community Profile

This section includes a profile of Carbon County and its municipalities. Information on the County's geographic profile, climate, demographic profile, and employment and industry profile are included below. While some information such as the study area boundaries and geography have remained unchanged, and derived from the 2015 Plan, other information such as the demographic and employment and industry information has been developed using the latest U.S. Census, the Comprehensive Regional Plan, and other recent Economic Development Strategy and Planning documents.

2.1. *Geography and Environment*

Carbon County is a 387.39 square mile county located in eastern Pennsylvania about 90 miles northeast of Philadelphia and 90 miles west of New York City. As seen in Figure 2.1-1, the County is bordered on the north by Luzerne County, on the east by Monroe County, on the west by Schuylkill County, and on the south by Lehigh and Northampton Counties.

Most of the land area of the County is hilly and the northern and eastern portions of the County are part of the Pocono Mountains region of the Commonwealth. Blue Mountain forms the southern boundary of Carbon County. The County is drained by the Lehigh River and its subwatersheds with the exception of a small area in western Packer Township and the Borough of Lansford that are drained by Still and Panther Creeks into the Schuylkill River, and an area in the northwest corner that drains into the Susquehanna River via the Catawissa Creek (Carbon County, 2013). The watersheds of Carbon County are displayed in Figure 2.1-2.

There are three state parks located fully or partially in Carbon County. The 15,990-acre Hickory Run State Park lies in the western foothills of the Pocono Mountains. The 3,002-acre Beltzville State Park is in the southern foothills of the Pocono Mountains. Lehigh Gorge State Park is 4,548 acres located partially in Carbon County and partially in Luzerne County.

Interstate 80 runs across the northern portion of the County. Interstate 476 runs north-south through the center part of the County, entering near the Township of White Haven and exiting through the Borough of Bowmanstown. Additionally, PA-209 runs through the middle of the County east-west between the Townships of Towamensing and Lansford. The locations of highways, boroughs, townships, and cities are provided on the basemap below.

Carbon County experiences an average annual temperature of about 47 degrees Fahrenheit and an average annual precipitation of approximately 45 inches. Carbon County, Pennsylvania gets 50 inches of rain, on average, per year. The US average is 38 inches of rain per year. Carbon County averages 40 inches of snow per year. The US average is 28 inches of snow per year. On average, there are 192 sunny days per year in Carbon County. The US average is 205 sunny days. The coldest average temperature is usually experienced in January at around 16 degrees Fahrenheit, while the warmest average temperature is in July at around 82 degrees Fahrenheit.

FIGURE 2.1-1 CARBON COUNTY BASEMAP

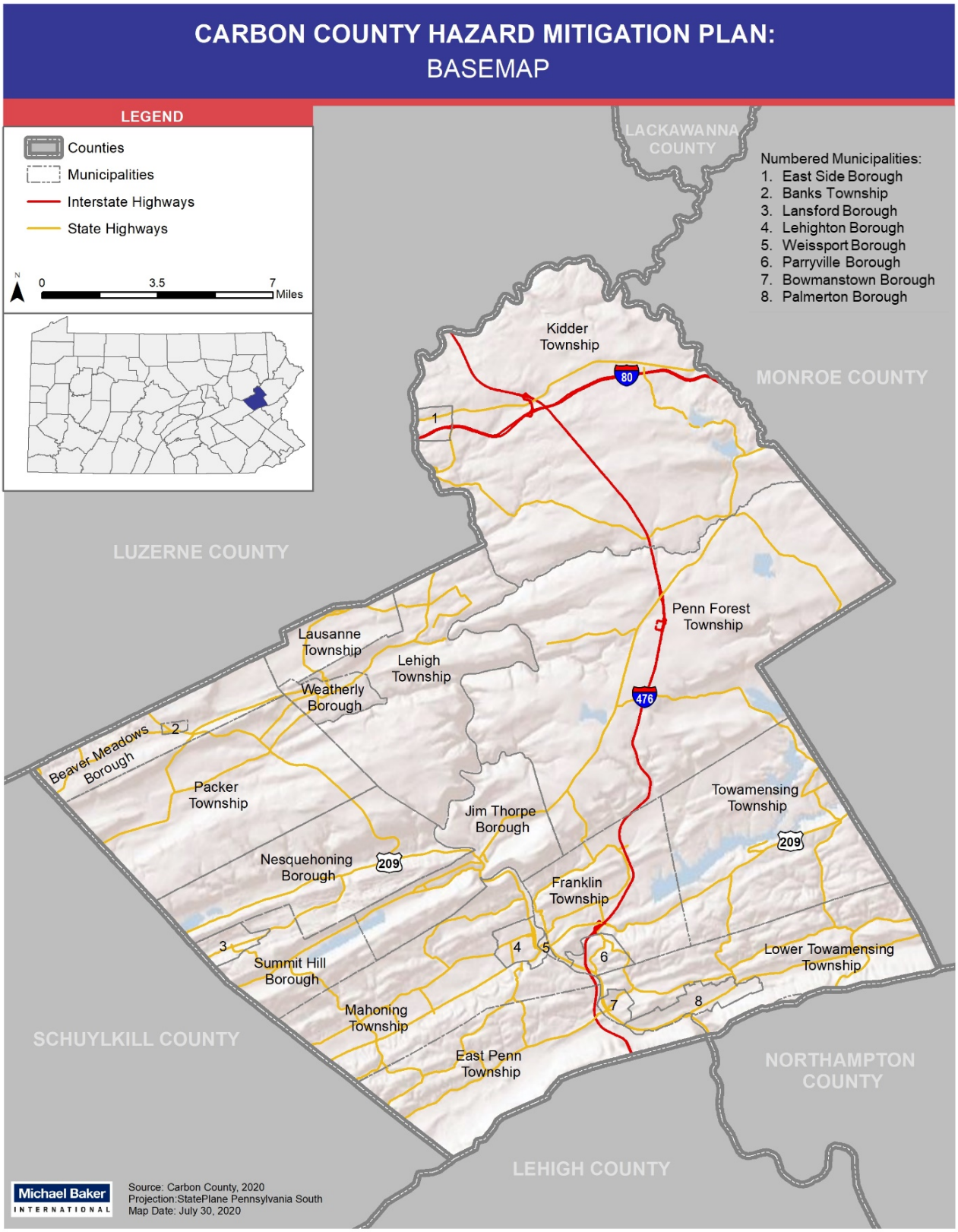
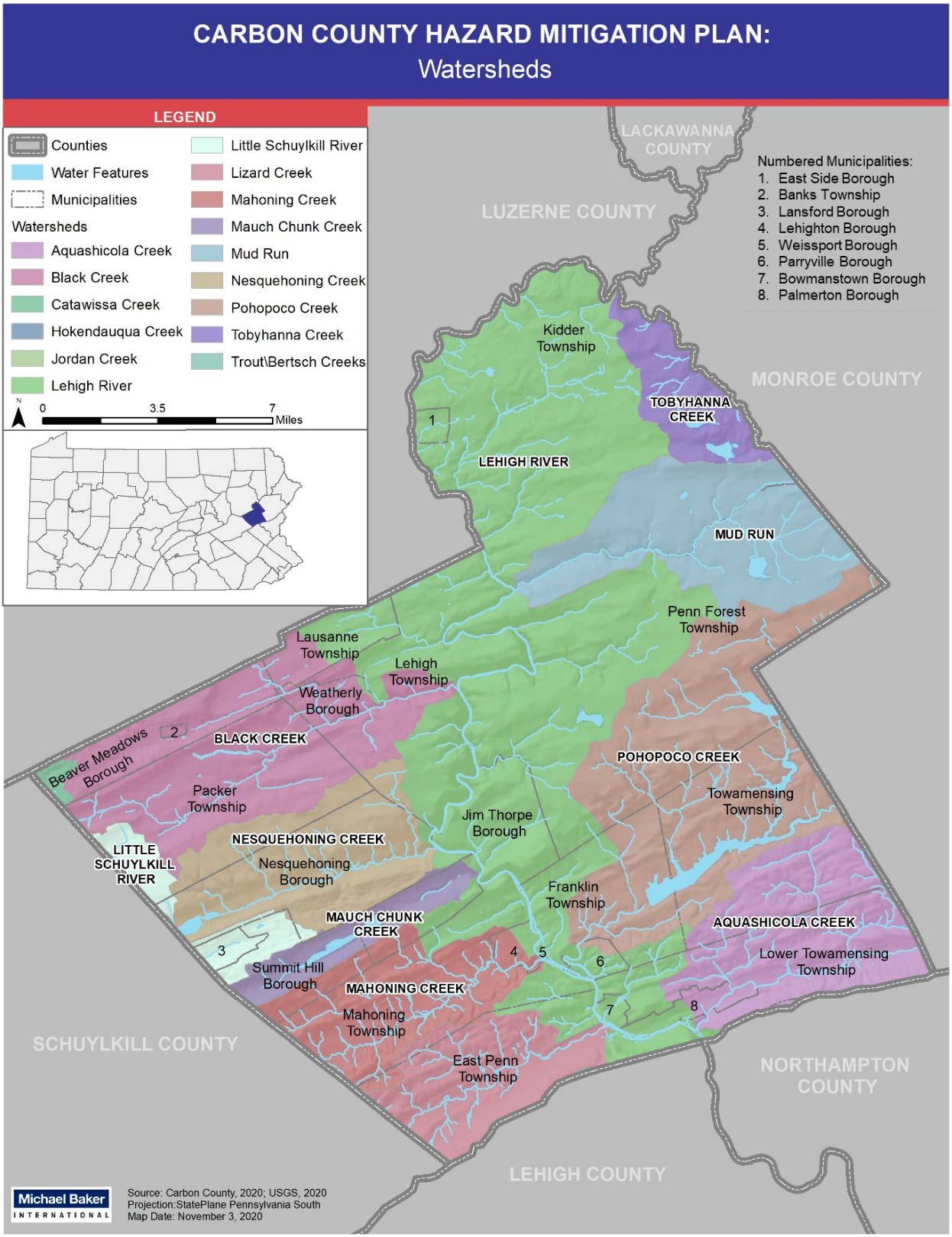


FIGURE 2.1-2 CARBON COUNTY WATERSHEDS



2.2. *Community Facts*

Carbon County was created in 1843 from parts of Northampton and Monroe Counties and was named for its coal deposits. The discovery of anthracite coal and railroad transportation in the mid-1800s helped the County rise to prominence. During the coal industry's boom period, Carbon County ranked second only to Schuylkill County in terms of coal production (DCED, 2005). Carbon County was home of the first large-scale railroad built in America called the "Switchback" railroad which was designed to carry coal (Carbon County, 2021a). A canal system was constructed along the Lehigh River to transport coal south to markets in Philadelphia.

Although coal mining was the prominent industry in Carbon County's history, the lumber and farming industries also attracted residents to Carbon County. However, the Great Depression and several large mining disasters caused the coal mining industry to weaken and the County to lose population until the 1970's when tourism began to grow in the County. Today, top employers in Carbon County are health care and social assistance, retail trade, accommodation and food services, manufacturing, and educational services (PA L&I, 2021). The County also produces dairy and poultry products, and manufactures fire equipment, die castings and garments (CCEMA, 2009).

Because of its vast natural resources, Carbon County has been and continues to grow in popularity as a tourist destination year-round. The County lies in the Pocono Mountain region of the state which draws many visitors. Many tourists flock to the County for sightseeing, historic tours, horseback riding, train rides, skiing, mountain biking, and water-skiing. In addition, the County contains the Lehigh River which has increasingly become more popular as a whitewater rafting river. All three Pennsylvania State Parks in Carbon County offer recreational amenities. The Delaware and Lehigh Canal National Heritage Corridor runs from a north to south direction through the County also drawing visitors.

2.3. *Population and Demographics*

The demographics of a community – population, labor force, employment, and housing reflect how a community has evolved in the past and has a direct bearing on how and where a community wants to develop in the future. The past population trends and projections as well as the employment characteristics help us to better understand the socio-economic characteristics that have and will continue to shape the future of this county. Some of Carbon County's demographic characteristics have been examined to provide an insight on how the community has changed over the last 40-45 years.

According to the U.S. Census, the population of Carbon County in 2019 estimated at just over 63,800. Table 2.3-1 below provides a distribution of County population by municipality obtained from the U.S. Census Bureau's 2019 American Community Survey (ACS) with five-year estimates. Population density, measured in the population per square mile (of land area), is highest in Beaver Meadows Borough (3,424.3), Weissport Borough (3,271.7), and Lehighton Borough (3,267.9). As shown in the table, the population decreased by 2.1% between 2010 and 2019. The greatest population decrease was seen in Kidder Township (-34.3%); however, this was only a decrease of 664 people as the municipality has a low population count. The greatest population increase was seen in Banks Township (18.3%); however, this was only an increase of 231 people. Overall, the county's population has remained relatively similar over the past decade. Municipalities with the highest population counts include Penn Forest

Township (9,626), Palmerton Borough (5,313), Lehighton Borough (5,304), and Jim Thorpe Borough (4,641).

TABLE 2.3-1 LIST OF MUNICIPALITIES IN CARBON COUNTY WITH ASSOCIATED POPULATIONS (U.S. CENSUS, 2019)

MUNICIPALITY	2010 POPULATION	2019 POPULATION	PERCENT CHANGE (%)
Banks Township	1,262	1,493	18.3%
Beaver Meadows Borough	869	884	1.7%
Bowmanstown Borough	937	910	-2.9%
East Penn Township	2,881	2,813	-2.4%
East Side Borough	317	324	2.2%
Franklin Township	4,262	4,157	-2.5%
Jim Thorpe Borough	4,781	4,641	-2.9%
*Kidder Township	1,935	1,271	-34.3%
Lansford Borough	3,941	3,796	-3.7%
Lausanne Township	237	234	-1.3%
Lehigh Township	479	502	4.8%
Lehighton Borough	5,500	5,304	-3.6%
Lower Towamensing Township	3,228	3,183	-1.4%
Mahoning Township	4,305	4,222	-1.9%
Nesquehoning Borough	3,349	3,239	-3.3%
Packer Township	998	1,012	1.4%
Palmerton Borough	5,414	5,313	-1.9%
Parryville Borough	525	520	-1.0%
Penn Forest Township	9,581	9,626	0.5%
Summit Hill Borough	3,034	2,943	-3.0%
Towamensing Township	4,477	4,419	-1.3%
Weatherly Borough	2,525	2,639	4.5%
Weissport Borough	412	442	7.3%
TOTAL	65,249	63,887	-2.1%

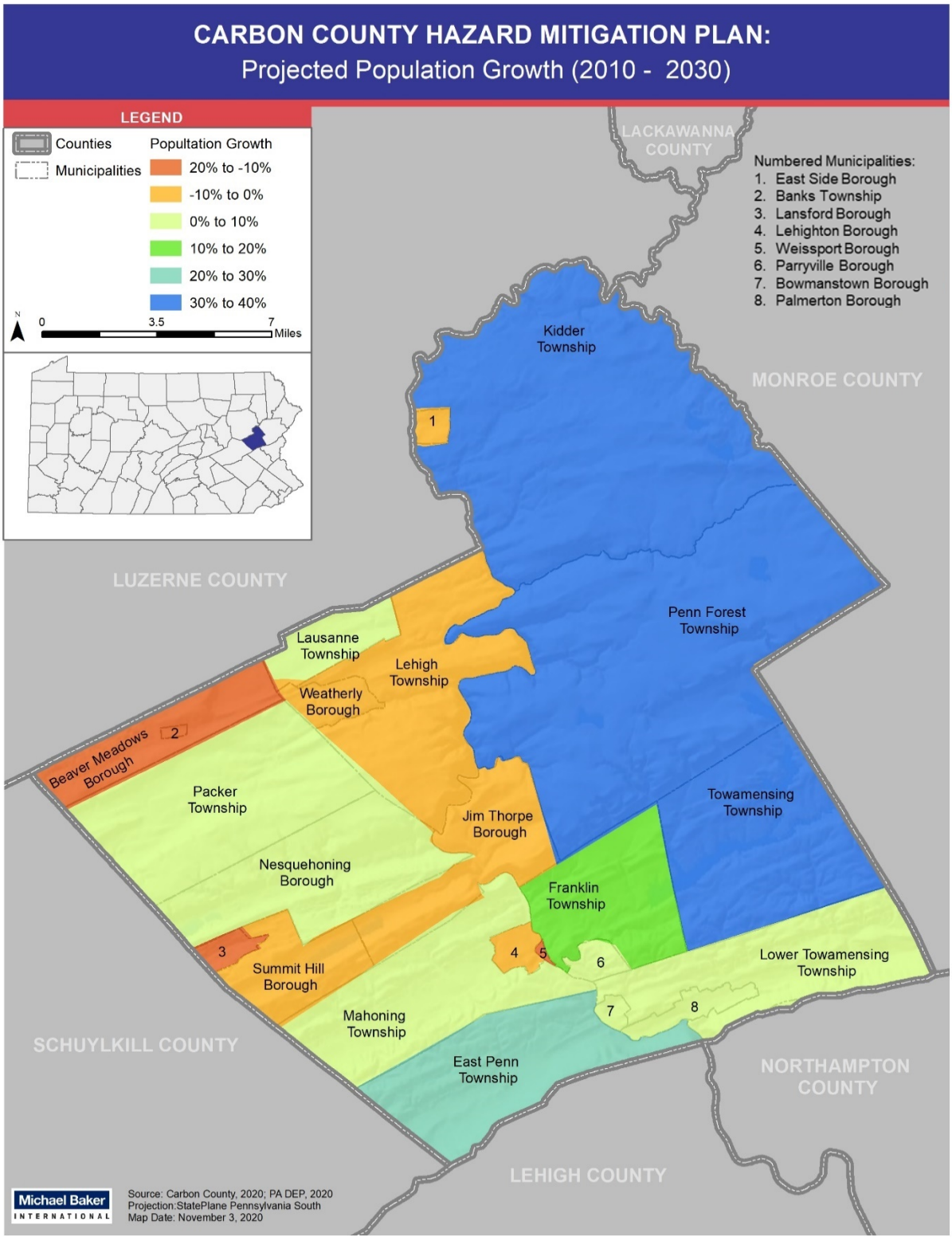
*According to the Carbon County Office of Planning and Development, the population of Kidder Township increases substantially Thursday through Sunday of each week as a result of an influx of tourists and people with vacation homes in the area. The municipality's population increases to approximately 20,000 each extended weekend year-round with those who take advantage of tourist and recreational amenities in the community including skiing, sightseeing, white-water rafting etc. These temporary increases in population are not taken into account in the above table's population numbers.

The population of Carbon County is concentrated around the center of the county seat in Jim Thorpe. Carbon County has historically experienced varying increases and decreases of persons per decade since 1920. The greatest increase was 9,700 people from 1910 to 1920. The greatest population decreased was 4,100 people from 1940 to 1950.

The median income of households in Carbon County is $57,006. This is approximately $6,170 less than the national median household income (U.S. Census Bureau, 2019). 11.7% of the Carbon County population lives in poverty; 19.5% of children under 18 are below the poverty line, compared with 8.2% of people 65 years or older. The median age of the County population is 46 years with 19.4% of the population under 18 years of age and 20.7% of the population aged 65 years or older. 86% of housing units in the County are single-unit structures, 10.5% are multi-unit structures, and 3.9% are mobile homes. The median monthly housing costs are $1,299 for mortgaged homeowners and $538 for non-mortgaged owners. The median rent is $830 per month. The majority, 95.7%, of the County population is White, 2.3% is African American, 4.8% is Hispanic, and 0.6% is Asian. The top five reported ancestries are: Polish, Irish, Italian, German, and English (U.S. Census Bureau, 2019).

Figure 2.3-1 shows the projected population change in Carbon County from 2010 to 2030 according to Carbon County GIS Department. The greatest population change is expected to be seen in the Northern portion of the county in Kidder Township, Penn Forest Township, and Towamensing Township. Projections show that these municipalities could see population increases from 30-40%. Low population increases or decreases are expected to be seen in already populated areas of the County, like Lehighton Township and Jim Thorpe Borough.

FIGURE 2.3-1 PROJECTED POPULATION CHANGE IN CARBON COUNTY FROM 2010 TO 2030



2.4. *Land Use and Development*

Land use in the County is classified as civic, commercial, industrial, residential, unknown, utility, vacant, and parks. The majority of land in Carbon County is residential. Most development is concentrated near Jim Thorpe and Lehighton; however residential development is seen throughout the County. Figure 2.4-1 illustrates the existing general land use in the County.

Figure 2.4-2 depicts tree coverage throughout Carbon County as classified by the United States Geological Service (USGS). Tree coverage is found by combining several national map layers: tree canopy, imperviousness, and land cover from the National Land Cover Database, and the National Hydrography and Transportation Datasets. Canopy values of 20 and greater are converted to woodland vector polygons, which are masked with buffered transportation and hydrography layers to exclude roads, airport runways, railroads, inundation areas, and waterbodies. Carbon County has approximately 73% tree coverage according to these analyses. While there is development throughout the County, much of it is located at the wildland/urban interface.

FIGURE 2.4-1 CURRENT LAND USE IN CARBON COUNTY

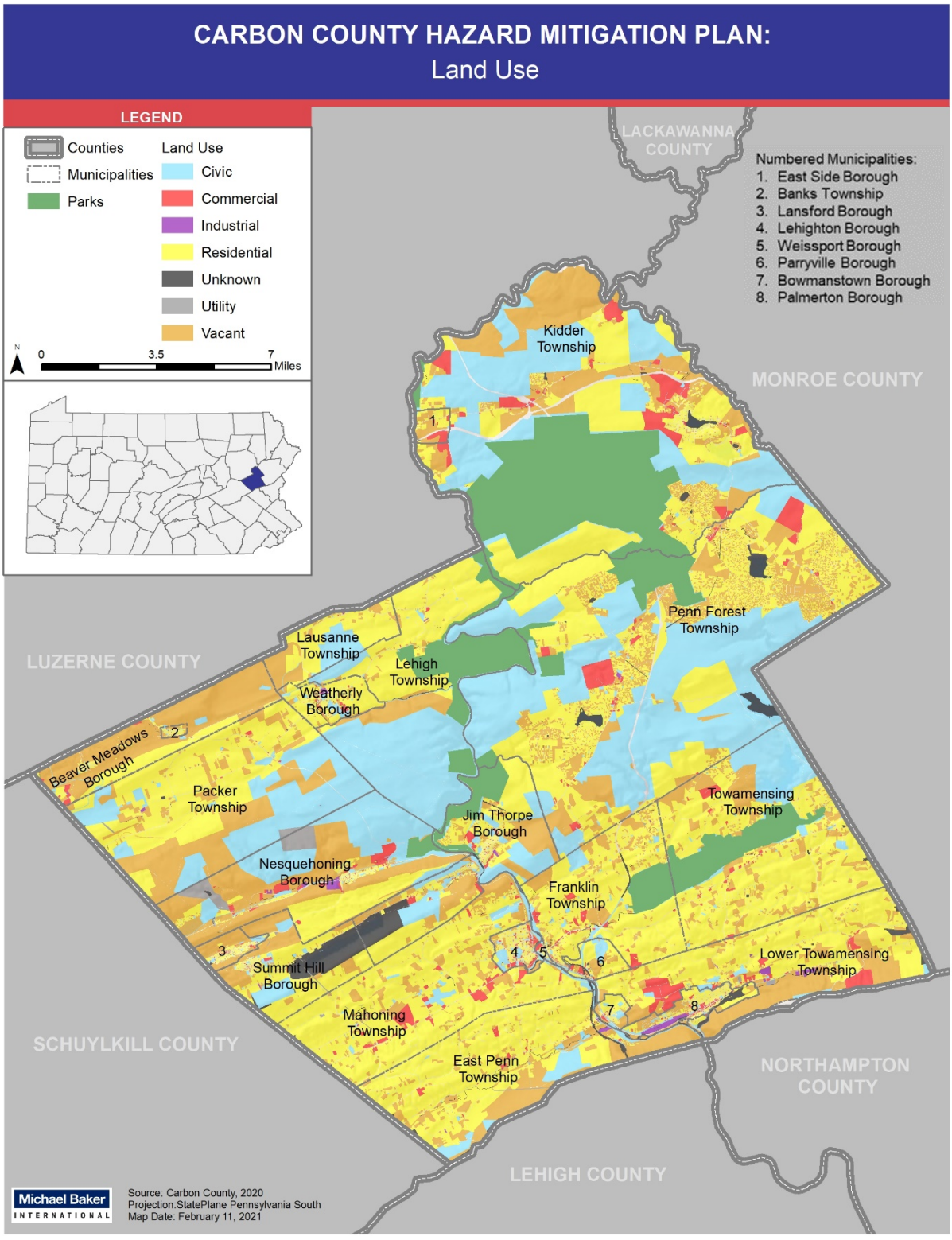
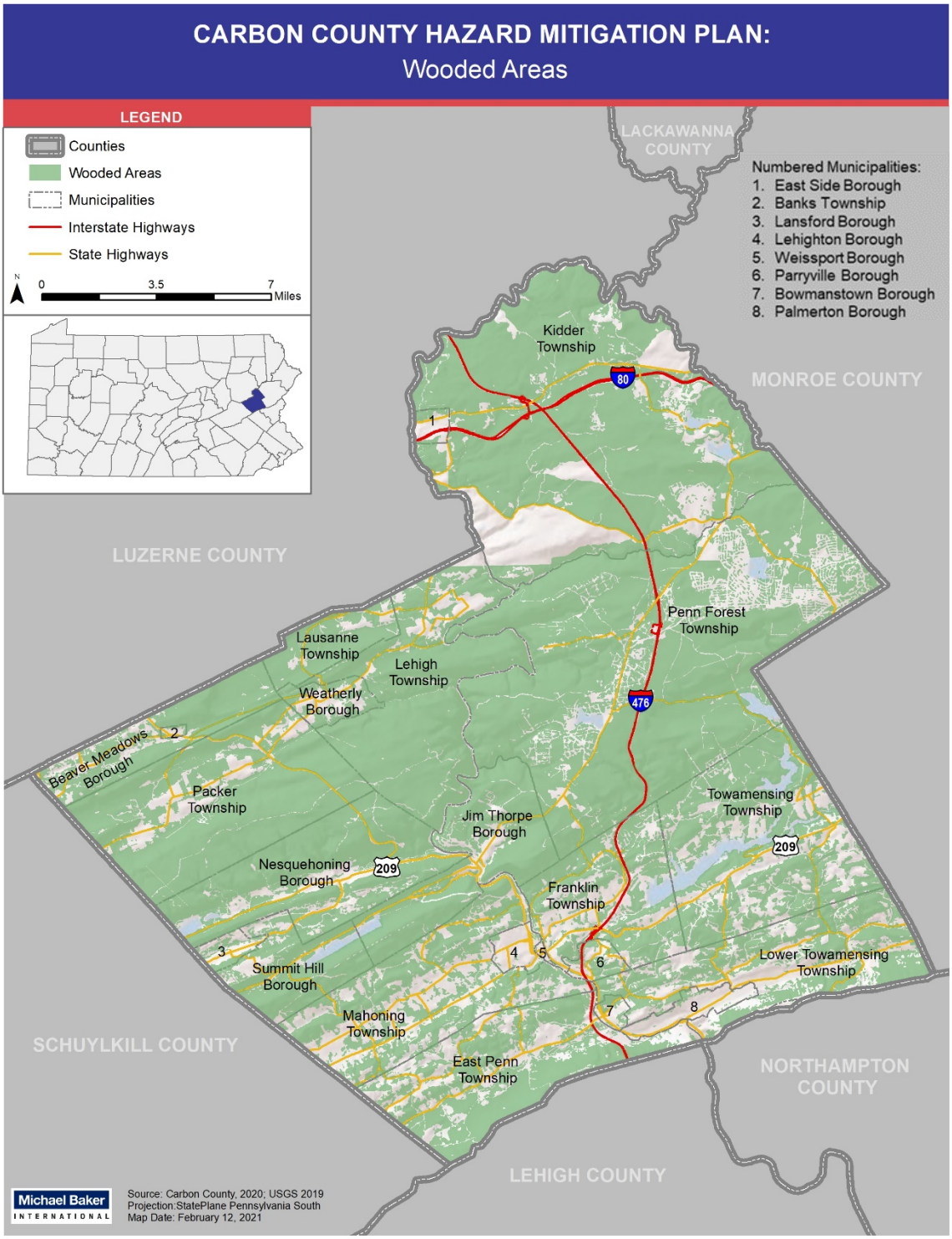


FIGURE 2.4-2 WOODED AREAS IN CARBON COUNTY



The Carbon County Comprehensive Plan and Greenway Plan lays out a Land Use and Housing Plan to guide development and redevelopment in the county through the year 2028. This plan is based on the projection of moderate population growth by about 3,800 people: an estimated average of 17.5% change between 2000 and 2030. Some municipalities will see a decrease in population by 10% while others will potentially see up to a 40% increase. The Future Land Use Plan identifies specific areas designated for conservation or resort and commercial recreation. The goal of creating these targeted growth areas is to protect existing residential neighborhoods, avoid overloading public resources and utilities, coordinate development across municipalities, and ensure development properly relates to the features of the land to avoid natural hazards. Areas designated for resort and commercial recreation uses are located near existing public recreation land or areas designated for conservation. This ensures a balance between conserving natural resources and promoting economic development. The plan identifies priority areas for open space conservation including: Blu Mountain/Kittatiny Ridge, Mauch Chunk Ridge, Bear Mountain, and the Black Creek Valley. Residential development is planned to go in and around existing centers of populated boroughs. Priority housing areas are located in Banks, Jim Thorpe, Kidder, Lansford, Lehighton, Mahoning, Nesquehoning, Palmerton, and Towamensing. This plan aims to move towards higher density residential areas to create more sustainability in the region (Carbon County, 2013).

An additional discussion of future land development and how it interacts with hazards is provided in Section 4.4.4.

2.5. *Data Sources and Limitations*

The Carbon County parcel database was used as an inventory of parcels and land use. The list of critical facilities provided in Appendix E – Critical Facilities was developed based on information provided by Carbon County Emergency Management Agency (EMA) and the Carbon County GIS Department and was the best available data.

The countywide Digital Flood Insurance Rate Map (DFRIM), published on June 3, 2002, was downloaded from the FEMA Map Service Center. This data provides flood frequency and elevation information used in the flood hazard risk assessment. Other GIS datasets including address points, cell towers, road centerlines, EMS stations, fire stations, police departments and school buildings were provided by the Carbon County GIS Department and datasets including municipal boundaries, railroads, waterbodies, watercourses and zip codes were downloaded from Carbon County's Open Data site. Population data from the 2000 and 2010 Census and 2019 American Community Survey results were obtained from the U.S. Census Bureau in 2021. Additional data for the base map was provided by the Pennsylvania Department of Transportation, Pennsylvania Game Commission, and the Pennsylvania Department of Conservation and Natural Resources.

CARBON COUNTY CONSIDERS EIGHT TYPES OF FACILITIES CRITICAL; OR ESSENTIAL TO THE HEALTH AND WELFARE OF THE COMMUNITY:

- **Airports**
- **Cell Towers**
- **Dams**
- **EMS Stations**
- **Fire Stations**
- **Hospitals**
- **Municipal Buildings**
- **Police Departments**
- **Schools**

Additional information used to complete the risk assessment for this plan was taken from various government agency and non-government agency sources. Those sources are cited where appropriate throughout the plan with full references listed in Appendix A – Bibliography. It should be noted that numerous GIS datasets were obtained from the Pennsylvania Spatial Data Access (PASDA) website (http://www.pasda.psu.edu/). PASDA is the official public access geospatial information clearinghouse for the Commonwealth of Pennsylvania. PASDA was developed by the Pennsylvania State University as a service to the citizens, governments, and businesses of the Commonwealth. PASDA is a cooperative project of the Governor's Office of Administration, Office for Information Technology, Geospatial Technologies Office and the Penn State Institutes of Energy and the Environment of the Pennsylvania State University.

In order to assess the vulnerability of different jurisdictions to the hazards, data on past occurrences of damaging hazard events was gathered. For a number of historic natural-hazard events, the National Centers for Environmental Information (NCEI) database was utilized. NCEI is a division of the US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by NCEI from data gathered by the National Weather Service (NWS), another division of NOAA. NCEI then presents it on their website in various formats. This plan relies on data provided via the US Storm Events database, which "documents the occurrence 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 NCEI, 2021).

HAZUS is a powerful risk assessment methodology for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH, current scientific and engineering knowledge is coupled with the latest GIS technology to produce estimates of hazard-related damage before, or after, a disaster occurs. This software was used to estimate losses for floods in Carbon County. Additionally, this plan uses information determined by FEMA's RiskMAP program calculating the Total Exposure in Floodplain (TEIF) using Census Block Total Exposure values that intersect with the Special Flood Hazard Area.

Throughout the risk and vulnerability assessment included in Section 4, descriptions of limited data indicate some areas in which the County and 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.

TABLE 2.5-1 CRITICAL FACILITIES BY MUNICIPALITY AND TYPE IN CARBON COUNTY.

Municipality	Airports	Cell Towers	Dams	EMS Stations	Fire Stations	Government Buildings	Hospitals	Police Departments	SARA and Tier II Facilities	Schools	Total
Banks Township	0	3	1	0	1	2	0	0	1	0	8
Beaver Meadows Borough	0	0	0	0	1	0	0	1	0	0	2
Bowmanstown Borough	0	1	0	0	1	1	0	0	1	0	4
East Penn Township	2	4	1	0	1	1	0	1	0	0	10
East Side Borough	0	0	0	0	0	1	0	0	0	0	1
Franklin Township	1	2	5	0	1	1	1	1	1	0	13
Jim Thorpe Borough	0	4	7	1	2	4	0	1	3	3	25
Kidder Township	0	11	18	1	3	1	0	1	0	1	36
Lansford Borough	0	0	0	0	1	1	0	1	2	0	5
Lausanne Township	0	1	1	0	0	1	0	0	0	0	3
Lehigh Township	1	0	3	0	1	1	0	0	0	1	7
Lehighton Borough	1	1	0	1	1	1	1	1	1	4	12
Lower Towamensing Township	0	2	0	0	1	1	0	0	2	2	8
Mahoning Township	1	3	1	1	1	1	1	1	0	1	11
Nesquehoning Borough	0	3	2	0	3	3	0	1	4	1	17
Packer Township	0	2	2	0	0	1	0	0	0	0	5
Palmerton Borough	0	2	0	1	1	1	0	1	3	4	13
Parryville Borough	0	1	1	0	1	1	0	0	0	0	4
Penn Forest Township	0	12	5	1	2	1	0	0	0	0	21
Summit Hill Borough	0	2	0	1	1	1	0	1	0	2	8
Towamensing Township	0	4	10	0	1	1	0	2	0	2	20
Weatherly Borough	0	0	1	1	1	1	0	1	0	2	7
Weissport Borough	0	0	0	0	0	1	0	1	0	1	3
Grand Total	**6**	**58**	**58**	**8**	**25**	**28**	**3**	**15**	**18**	**24**	**243**

3. Planning Process

3.1. *Update Process Summary*

This Carbon County HMP was originally developed in 2010 and then updated and adopted for implementation in 2015. The 2010 Plan, 2015 Plan, and this updated 2021 Carbon County HMP represent the work of citizens, government officials, business leaders, and volunteers of non-profit organizations in developing a blueprint for protecting community assets, preserving the economic viability of the community, and saving lives. The current update to the 2015 HMP was initiated in April 2020. The Carbon County 2021 HMP Update was completed in June 2021.

The 2021 HMP follows the Pennsylvania Hazard Mitigation Model Plan Outline developed by PEMA in 2013 which provides a standardized format for all multi-jurisdictional HMPs in the Commonwealth of Pennsylvania. The Plan Update was led by the Hazard Mitigation Plan Steering Committee (HMPSC) and informed by the Hazard Mitigation Planning Team (HMPT). Community leaders and other agency and organizational stakeholders were invited by the Carbon County Department of Planning & Zoning, and the Carbon County Emergency Management Agency, to participate in the Plan Update process.

3.2. *The Planning Team*

Members of the HMPT are listed below in Table 3.2-1. The HMPSC met May 27, 2020 to discuss the plan update process including FEMA and PEMA requirements and guidance, a schedule for deliverables and meetings, participation and contacts for the HMPT, and currently available data and documentation to inform the 2021 update.

TABLE 3.2-1 CARBON COUNTY HAZARD MITIGATION PLAN STEERING COMMITTEE

PARTICIPANT	TITLE
David Bodnar	Director, Caron County Office of Planning and Development
Mark Nalesnik	Director, Carbon County Emergency Management Agency
Justin Markell	Assistant 911 Manager, Carbon County Communication Center
Wesley Keller	Forest Fire Specialist Supervisor, DCNR - Forestry

THE 2021 CARBON COUNTY HAZARD MITIGATION PLANNING TEAM INCLUDED:

MUNICIPAL OFFICIALS

THREE CARBON COUNTY DEPARTMENTS AND AGENCIES

PA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES -BUREAU OF FORESTRY

The HMPT was organized by the County, with assistance from consultant Mitigation Planner, to plan meetings, collect information, and conduct outreach. The HMPT included municipal officials, Carbon County government representatives, non-profit organizations, and other stakeholders such as school superintendents, regional police

departments and regional government councils. Adjacent county representatives from all five neighboring counties (Lehigh, Luzerne, Monroe, Northampton, and Schuylkill) were invited to participate, though no other County participated in this update. Other stakeholders that were part of the HMPT are listed at the end of Table 3.2-2 below. Stakeholder and other participation documentation is provided in Appendix C – Meeting and Other Participation Documentation.

Stakeholders participated by attending meetings and submitting valuable input and feedback to inform the planning process in form of completed surveys, questionnaires, and verbal comment. Letters, email, and telephone, social media, and the project website, were utilized to coordinate and communicate with the HMPT. A brief description of each meeting that was held is provided in Section 3.3. In addition, detailed meeting minutes describing events of each meeting are available in Appendix C – Meeting and Other Participation Documentation.

All 23 municipalities participated in the hazard mitigation planning process by both attending a meeting and submitting a form or comment. The participants listed in Table 3.2-2 served on the 2021 countywide HMPT and actively participated in the planning process. In addition, representatives from Penn Forest Fire Control Station, Palmerton Area School District, Hickory Run State Park, Carbon County GIS, Carbon Conservation District, and Carbon Engineering attended meetings or had one-on-one consultations during the planning process. While additional attempts were made to include various other stakeholders such as local dam owners, no response was received from PADEP regarding the inclusion of high hazard potential dam owners in the planning process. Carbon County will continue working to involve stakeholders in the planning process during future updates.

TABLE 3.2-2 HAZARD MITIGATION PLANNING PROCESS PARTICIPATION

MUNICIPALITY/ORGANIZATION	PARTICIPANT(S)
Banks Township	Gregory Haas, Charles Schalles
Beaver Meadows Borough	Haileigh Biever, Tom Wassil
Bowmanstown Borough	Brian Uhnak, Tara Takerer
East Penn Township	Jillyan Sterling, Gregory Haas
East Side Borough	Carol Lenahan, Elizabeth Berger, Meri Jones
Franklin Township	Larry Diehl, Gregory Haas
Jim Thorpe Borough	Darrin Arndt
Kidder Township	Suzanne Brooks
Lansford Borough	Justin Markell, Jack Soberick, Michele Bartek
Lausanne Township	Paula Hoffman
Lehigh Township	Carol Lenahan, Gregory Haas
Lehighton Borough	Brenda Kreitz, Joe Flickinger
Lower Towamensing Township	Rory Koons, Gregory Haas
Mahoning Township	Carol Etheridge (Resident)
Nesquehoning Borough	Gregory Haas
Packer Township	Stephanie Stolpe, Gregory Haas
Palmerton Borough	Donna McGarry
Parryville Borough	Jason Smith, Thomas Kobal
Penn Forest Township	David Michael
Summit Hill Borough	Gregory Haas, Kira Steber
Towamensing Township	Gregory Haas

MUNICIPALITY/ORGANIZATION	PARTICIPANT(S)
Weatherly Borough	James Wetzel
Weissport Borough	David Horst

3.3. *Meetings and Documentation*

The following meetings were held during the plan update process. Invitations, agendas, sign-in sheets, and minutes for these meetings are included in Appendix C.

May 27, 2020 – Steering Committee Meeting was attended by County representatives and the consultant to go over the planning process and major milestones including the schedule for HMPT meetings and anticipated HMP submission dates. The group also discussed planning requirements, relevant stakeholders, and the availability of geospatial data and other plans and documentation for integration.

August 19, 2020 – Planning Team Kick-Off Meeting held virtually (due to COVID-19 Pandemic restrictions) to discuss project scope, schedule, goals, the planning process, participation and engagement, and next steps. Hazards from the 2015 plan were reviewed with the HMPT at the kick-off. Morning and evening sessions were offered to maximize opportunities for participation. During these meetings, county staff, municipal representatives, and interested stakeholders provided vital information on changes in hazard risk and local capabilities to mitigate those risks since the last HMP update. Municipal attendees completed an "Evaluation of Hazards and Risk Form" to identify their jurisdictional risk to each hazard. Capability Assessment Surveys were also completed by municipal attendees.

October 23, 2020 – Steering Committee Review Meeting was attended by County representatives and the consultant to discuss new hazards being profiled, municipal participation to date and to conduct a comprehensive review of Mitigation Strategy Goals and Objectives.

November 18, 2020 – Risk Assessment and Mitigation Solutions Workshop held virtually to discuss Carbon County's hazard vulnerability and new hazards to be profiled in the 2021 HMP. Morning and evening sessions were offered to provide additional opportunity for participation. Participants discussed progress of mitigation actions from the 2015 Plan Update and identified additional mitigation actions that would help reduce or eliminate potential losses

February 10, 2021 – Steering Committee Review Meeting was attended by County representatives to discuss the finalization of critical facilities data and a review of mitigation actions and mitigation progress.

April 28, 2021 – Public Draft Plan Review Meeting held via webinar due to mandated government requirements related to the COVID-19 response. The purpose of this final HMPT meeting was to provide information about the update process, evaluation, and general findings in the Carbon County HMP. Additionally, instructions about when and how to review the Draft HMP were covered as well as a final timeline for the review and submission of the HMP to PEMA and FEMA. Morning and evening webinars were offered and attended.

3.4. *Public & Stakeholder Participation*

Each municipality was given multiple opportunities to participate in the plan update process through invitation to above outlined meetings, review of risk assessment results and mitigation actions, one-on-one phone consultations, and an opportunity to comment on a final draft of the 2021 Hazard Mitigation Plan Update. The tools listed below were distributed with meeting invitations, at meetings, and on the plan update website to solicit information, data, and comments from both local municipalities and other key stakeholders in Carbon County. Responses to these worksheets and surveys are included in Appendix C: Meeting and Other Participation Documentation.

- Capability Assessment Survey: Collects information on local planning, regulatory, administrative, technical, fiscal, and education and outreach capabilities that can be included in the plan's Capability Assessment section.
- Evaluation of Hazards and Risk Form: Collects information from the HMPT regarding whether there have been changes to the frequency of occurrence, magnitude of impact, or geographic extent of hazards identified in the 2015 plan. In addition, the form asks members of the HMPT to select any additional hazards they believe should be considered for inclusion in the 2021 plan.
- Mitigation Progress Report: This form was specific to each jurisdiction and included all actions for that jurisdiction in the 2015 HMP with space to provide the current status of each action and document any progress made.
- New Mitigation Action Form: This form was provided to communities that wanted to include a new action in the HMP. The purpose was to collect details about the action, including priority, responsible parties, potential partners, potential funding sources, implementation timeframe, and more.

Public and stakeholder participation and comment was encouraged throughout the planning process, particularly through the project website, www.pennsylvaniahmp.com/carbon-county-hmp. This site was created and made publicly available at the very beginning of the planning process and acted as a repository for the entire planning process and housed presentations, agendas, minutes, and worksheets from each meeting as well as promulgating meeting dates, times, and important announcements.

FIGURE 3.4-1 CARBON COUNTY OUTREACH EFFORTS UTILIZING SOCIAL MEDIA

The website hosted a Community Mitigation Survey which gathered information about how the public preferred to receive information about risk and hazards as well as data about financial risk protection and interest in continuing education. The County shared the Community Mitigation Survey with its municipalities via email and encouraged them to share with their residents. Seven responses were received through the survey. Responses were submitted from various

parts of the County including East Side Boro, Jim Thorpe Borough, Lehighton Borough, Mahoning Township, and Penn Forest Township. Members of the community provided answers to survey questions including the types of insurance carried, how informed they feel about risks from the hazards impacting the community, the hazards they feel most impact their community, any types of hazard preparedness activities done at home, interest in attending public information sessions related to risk and preparedness, etc. The survey informed the Planning Team that 42% of respondents felt "somewhat informed" about the risk from hazards affecting Carbon County, with almost 29% answering that "There's probably a lot I'm not aware of." All of the information collected from the survey was used to help inform the plan and furthermore, can be used to strategize on public outreach and education efforts coordinated by the County and each locality.

In addition to the website and the survey, the Carbon County Commissioners also posted information about the plan update and ways to participate on their social media platform. A public notice was printed in the Times News inviting the public to the Draft Plan Review Meeting and asking for community feedback during the Public Comment Period.

3.5. *Multi-Jurisdictional Planning*

This HMP was developed using a multi-jurisdictional approach. Though County level departments have resources such as technical expertise and data which local jurisdictions may lack; involvement from local municipalities is critical to the collection of local knowledge related to hazard events. Local municipalities also have the legal authority to enforce compliance with land use planning and development issues. The Steering Committee was committed to garnering municipal participation. All Carbon County municipalities participated in the plan update. Table 3.5-1 lists jurisdictional participation in the 2021 HMP.

The Kick-off Meeting, Risk Assessment Summary/Mitigation Solutions Workshop, and Draft Plan Review meetings were held virtually due to COVID-19 restrictions; morning and afternoon sessions were offered and attended. Each municipality was emailed and mailed invitations and reminders to all meetings. Surveys and forms were provided at meetings, posted to the project website, or emailed to jurisdictions (in advance of virtual meetings) with a link to online materials. For communities that were unable to attend a meeting or wanted to have further discussion or guidance on how to fill out forms, one-on-one phone consultations were provided throughout the planning process. One-on-one calls and email correspondence with municipal officials was crucial to gathering feedback and information related to local capabilities and mitigation progress in particular. This was especially important during the final weeks of the planning process when travel and gatherings were restricted during the pandemic.

There are numerous existing regulatory and planning mechanisms in place at the state, county, and municipal level of government which support hazard mitigation planning efforts. These tools include the Commonwealth of Pennsylvania Standard All-Hazard Mitigation Plan, local floodplain management ordinances, the Carbon County Comprehensive Plan & Greenway Plan, Carbon County Emergency Operations Plan, local Emergency Operation Plans, local zoning ordinances, local subdivision and land development ordinances, and local comprehensive plans. These mechanisms were discussed at community meetings and are described in Section 5.2. Information from several of these documents has been incorporated

into this plan and mitigation actions have been developed to further integrate these planning mechanisms into the hazard mitigation planning process.

Information on identified development constraints and potential future growth areas was incorporated from the Carbon County Comprehensive Plan & Greenway Plan so that vulnerability pertaining to future development could be established. Floodplain management ordinance information was used to aid in the establishment of local capabilities in addition to participation in the NFIP.

TABLE 3.5-1 2021 CARBON COUNTY MUNICIPAL PARTICIPATION

MUNICIPALITY	COUNTY HMP MEETINGS				WORKSHEETS AND EXERCISES					
	HAZARD MITIGATION PLAN KICK-OFF MEETING	RISK ASSESSMENT AND MITIGATION SOLUTIONS WORKSHOP	PUBLIC MEETING	PHONE CONSULTATION	EVALUATION OF IDENTIFIED HAZARDS AND RISK WORKSHEET	CAPABILITY ASSESSMENT SURVEY	NFIP COMPLIANCE AND CAPABILITIES SURVEY	JURISDICTIONAL HAZARD RISK RANKING FORM	MITIGATION ACTION PROGRESS FORM	PLAN COMMENT FORM
Banks Township		X							X	
Beaver Meadows Borough				X	X	X	X	X		
Bowmanstown Borough	X								X	
East Penn Township		X		X	X	X	X			
East Side Borough		X		X	X	X	X		X	
Franklin Township	X	X	X		X	X	X	X	X	
Jim Thorpe Borough	X		X					X	X	
Kidder Township				X	X	X	X		X	
Lansford Borough	X	X		X		X				
Lausanne Township				X	X	X		X		
Lehigh Township		X			X	X	X		X	
Lehighton Borough	X	X	X		X	X	X			
Lower Towamensing Township		X	X		X					
Mahoning Township				X	X			X		
Nesquehoning Borough		X		X						
Packer Township		X			X	X	X			
Palmerton Borough	X		X		X	X				
Parryville Borough			X						X	
Penn Forest Township				X						X
Summit Hill Borough		X							X	

Towamensing Township		X		X						
Weatherly Borough	X				X	X	X			
Weissport Borough				X						X

4. Risk Assessment

4.1. *Update Process Summary*

To reduce the potential for damage due to hazards, it is necessary to identify hazards that may affect the County. This risk assessment provides a factual basis for activities proposed by the County in its mitigation strategy. Hazards that may affect Carbon County are identified and defined in terms of location and geographic extent, magnitude of impact, previous events and likelihood of future occurrence. All information from the previous plan has been included or updated in the 2021 Plan, unless otherwise indicated. The Carbon County HMPT reviewed the hazards profiled in the 2015 Carbon County HMP during the August 19, 2020 Kick-Off Meeting. The HMPT determined that all the existing hazards should be carried over into the 2021 plan update and decided that two additional hazards should be profiled in the 2021 plan update: Civil Disturbance and Pandemic and Infectious Disease. The hazards selected by the HMPT were then reviewed at the November 18, 2020 Risk Assessment and Mitigation Solutions Workshop. The municipalities completed an Evaluation of Hazards and Risk Form to indicate their jurisdictional risk to each hazard that would be profiled in the 2021 plan. Due to changes in the County and globally over the last five years, hazards like Drowning and Wildfire were determined to be of higher risk than they were in the 2015 plan.

HAZARD PROFILES IN THE 2021 HMP INCLUDE THE FOLLOWING HAZARDS:

- **Drought**
- **Flood, Flash Flood, Ice Jam**
- **Hailstorm**
- **Hurricane, Tropical Storm, Nor'easter**
- **Landslide**
- **Pandemic & Infectious Disease**
- **Radon Exposure**
- **Wildfire**
- **Winter Storm**
- **Building & Structure Collapse**
- **Civil Disturbance**
- **Dam Failure**
- **Disorientation**
- **Drowning**
- **Environmental Hazards**
- **Levee Failure**
- **Nuclear Incidents**
- **Transportation Accident**
- **Utility Interruption**

Hazard profiles were then developed in order to define the characteristics of each hazard as it applies to Carbon County. This process was completed using published information and web sites that address hazards globally, nationally, within Pennsylvania, or specifically within Carbon County as well as anecdotal information provided by members of the HMPT.

Following hazard identification and profiling, a vulnerability assessment was performed to identify the impact of natural hazard events on people, buildings, infrastructure, and the community. Each natural hazard is discussed in terms of its potential impact on individual communities in Carbon County, including the types of parcels and critical facilities that may be at risk. The assessment allows the County and its municipalities to focus mitigation efforts on areas most likely to be damaged or most likely to require early response to a hazard event. A vulnerability analysis was performed which identifies structures, critical facilities, or people that may be impacted by hazard events and describes what those events can do to physical, social, and economic assets. Depending upon data availability, assessment results consist of an inventory of vulnerable structures or populations.

4.2. *Hazard Identification*

4.2.1. Table of Presidential Disaster Declarations

Presidential Disaster and Emergency Declarations are issued when it has been determined that state and local governments need assistance in responding to a disaster event. Table 4.2-1 identifies the 16 Presidential Disaster and Emergency Declarations issued between 1965 through 2020 that have affected Carbon County. Additional declarations beyond 2020 can be found on the FEMA website at: http://www.fema.gov/disasters.

TABLE 4.2-1 PRESIDENTIAL DISASTER AND EMERGENCY DECLARATIONS AFFECTING CARBON COUNTY.

DECLARATION NUMBER	DATE	EVENT
4506	3/30/2020	COVID-19 Pandemic
3441	3/13/2020	COVID-19
3356	10/29/2012	Emergency Declaration - Hurricane Sandy
3340	9/8/2011	Emergency Declaration – Remnants of Tropical Storm Lee
1649	6/30/2006	Proclamation of Emergency - Flooding
3235	9/10/2005	Proclamation of Emergency - Hurricane Katrina
1557	9/19/2004	Tropical Depression Ivan
3180	3/14/2003	Severe Winter Storms
1093	1/21/1996	Flooding
1085	1/13/1996	Blizzard of 1996
1015	3/10/1994	Severe Winter Storms
3105	3/16/1993	Blizzard
745	10/8/1985	Hurricane Gloria
3026	1/29/1977	Snowstorms
340	6/23/1972	Tropical Storm Agnes
273	8/19/1969	Severe Storms and Flooding
206	8/18/1965	Drought and Water Shortage

As shown above, since 1965, declarations have been issued for various hazard events including hurricanes or tropical storms, severe winter storms, and flooding. A unique Presidential Emergency Declaration was issued in September 2005. Through Emergency Declaration 3235, President George W. Bush declared that a state of emergency existed in the Commonwealth of Pennsylvania and ordered federal aid to supplement Commonwealth and local response efforts to help people evacuated from their homes due to Hurricane Katrina. All counties within the Commonwealth, including Carbon County, were indirectly affected by Hurricane Katrina as a result of evacuee assistance.

4.2.2. Summary of Hazards

The table below summarizes hazards identified in the 2015 Carbon County HMP Update.

TABLE 4.2-1 NATURAL HAZARDS IDENTIFIED IN THE CARBON COUNTY 2015 MITIGATION PLAN UPDATE.

HAZARDS		
Drought	Flood, Flash Flood, Ice Jam	Hailstorm

HAZARDS		
Hurricane, Tropical Storm, Nor'easter	Landslide	Radon Exposure
Wildfire	Winter Storm	Building & Structure Collapse
Dam Failure	Disorientation	Drowning
Environmental Hazards	Levee Failure	Nuclear Incidents
Transportation Accident	Utility Interruption	

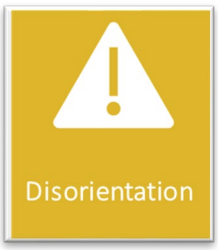
All hazards identified in 2015 plan were included in the 2021 HMP update. The hazards were reviewed by the HMPT at the August 19, 2020 Kick-Off Meeting. Each municipal attendee was provided with an *Evaluation of Hazards and Risk Form* and the PEMA Standard List of Hazards which is a comprehensive list of all hazards to be considered for evaluation in the 2021 plan.

Following review of this hazards list and completion of the *Evaluation of Hazards and Risk Form*, the HMPT determined that one new hazards would be included in the 2021 HMP Update: Civil Disturbance. Table 4.2-2 contains a complete list of all potential hazards in Carbon County identified through the risk assessments and planning meetings. Hazard profiles are included in Section 4.3 for each of these hazards.

TABLE 4.2-2 LIST AND DESCRIPTION OF NATURAL AND HUMAN-MADE HAZARDS PROFILED IN THE 2021 HAZARD MITIGATION PLAN UPDATE. (PA 2018 STANDARD OPERATING GUIDE)

HAZARD	HAZARD DESCRIPTION
NATURAL HAZARDS	
	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 farms and other water-dependent industries, water-dependent recreation uses, and residents who depend on wells for drinking water. (National Drought Mitigation Center, 2018; Ready.gov 2018).
	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 (PEMA, 2018). 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. (FEMA, 2018). 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. (NESEC, 2018).

HAZARD	HAZARD DESCRIPTION
	Hailstorms occur when ice crystals form within a low-pressure front due to the rapid rise of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation in the form of balls or irregularly shaped masses of ice greater than 0.75 inches in diameter. Hailstorms can cause significant damage to homes, vehicles, livestock, and people. (FEMA, 2018; NOAA, 2018).
	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 flooding, rip currents, tornadoes, and landslides. The Atlantic hurricane season runs from June 1 to November 30. (NOAA, 2018; Ready.gov, 2018).
	In a landslide, masses of rock, earth or debris move down a slope. Landslides can be caused by a variety of factors, including earthquakes, storms, fire, and human modification of land. Areas that are prone to landslide hazards include previous landslide areas, areas on or at the base of slopes, areas in or at the base of drainage hollows, developed hillsides with leach field septic systems, and areas recently burned by forest or brush fires. (PA DCNR, 2018 and USGS, 2018).
	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 disproportional 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. (FEMA, 2018).
	Radon is a cancer-causing natural radioactive gas that you can't see, smell, or taste. It is a large component of the natural radiation that humans are exposed to and can pose a serious threat to public health when it accumulates in poorly ventilated residential and occupation settings. According to the USEPA, radon is estimated to cause about 21,000 lung cancer deaths per year, second only to smoking as the leading cause of lung cancer (EPA 402-R-03-003: EPA Assessment, 2003). An estimated 40% of the homes in Pennsylvania are believed to have elevated radon levels (Pennsylvania Department of Environmental Protection, 2009).
	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 period of little rain. In Pennsylvania, 98% of wildfires are caused by people (Ready.gov, 2018 and PA DCNR, 2018).

HAZARD	HAZARD DESCRIPTION
	A winter storm is a storm in which the main types of precipitation are snow, sleet, or freezing rain. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Most deaths from winter storms are not directly related to the storm itself, but result from traffic accidents on icy roads, medical emergencies while shoveling snow, or hypothermia from prolonged exposure to cold. (NOAA, 2018).
HUMAN-MADE HAZARDS	
	Buildings and other engineered structures, including bridges, may collapse if their structural integrity is compromised, especially due to effects from other natural or human-made hazards. Older buildings or structures, structures that are not built to standard codes, or structures that have been weakened are more susceptible to be affected by these hazards.
	A civil disturbance is defined by FEMA as a civil unrest activity (such as a demonstration, riot, or strike) that disrupts a community and requires intervention to maintain public safety. (FEMA, 2018)
	Dam failure is the uncontrolled release of water (and any associated wastes) from a dam. This hazard often results from a combination of natural and human causes, and can follow other hazards such as hurricanes, earthquakes, and landslides. The consequences of dam failures can include property and environmental damage and loss of life. (ASDSO, 2018).
	Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. Search and rescue efforts are focused in and around state forest and state park lands (DCNR, 2009).
	Unintentional drowning can be a significant hazard in communities with numerous water bodies (e.g. ponds, lakes, rivers, etc.) and extensive outdoor recreational activity. Water related recreational opportunities such as fishing, boating, and swimming popular among visitors present more opportunities for residents and visitors to unintentionally drown.

HAZARD	HAZARD DESCRIPTION
	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 for Carbon County include the following: • Coal Mining Incidents: including the release of harmful chemical and waste materials into water bodies or the atmosphere, explosions, fires, and other hazards and threats to life safety stemming from mining (Environmental Protection Agency, Natural Disaster PSAs, 2009).
	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. (USACE, 2018).
 	Nuclear explosions can cause significant damage and casualties from blast, heat, and radiation. The primary concern following a nuclear accident or nuclear attack is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects. (EPA, 2018; Ready.gov, 2018). Transportation accidents can result from any form of air, rail, water, or road travel. It is unlikely that small accidents would significantly impact the larger community. However, certain accidents could have secondary regional impacts such as a hazardous materials release or disruption in critical supply/access routes, especially if vital transportation corridors or junctions are present. Traffic congestion in certain circumstances can also be hazardous. Traffic congestion is a condition that occurs when traffic demand approaches or exceeds the available capacity of the road network. This hazard should be carefully evaluated during emergency planning since it is a key factor in timely disaster or hazard response, especially in areas with high population density (Federal Highway Administration, 2015).
	Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications, public works, and information network sectors.

4.3. *Hazard Profiles and Vulnerability Analysis*

Natural Hazards

4.3.1. **Drought**

Drought is a natural climatic condition which occurs in virtually all climates; the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. This hazard is of particular concern in Pennsylvania due to the presence of farms as well as water-dependent industries and recreation areas across the Commonwealth. A prolonged drought could severely affect these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses (National Drought Mitigation Center, 2020).

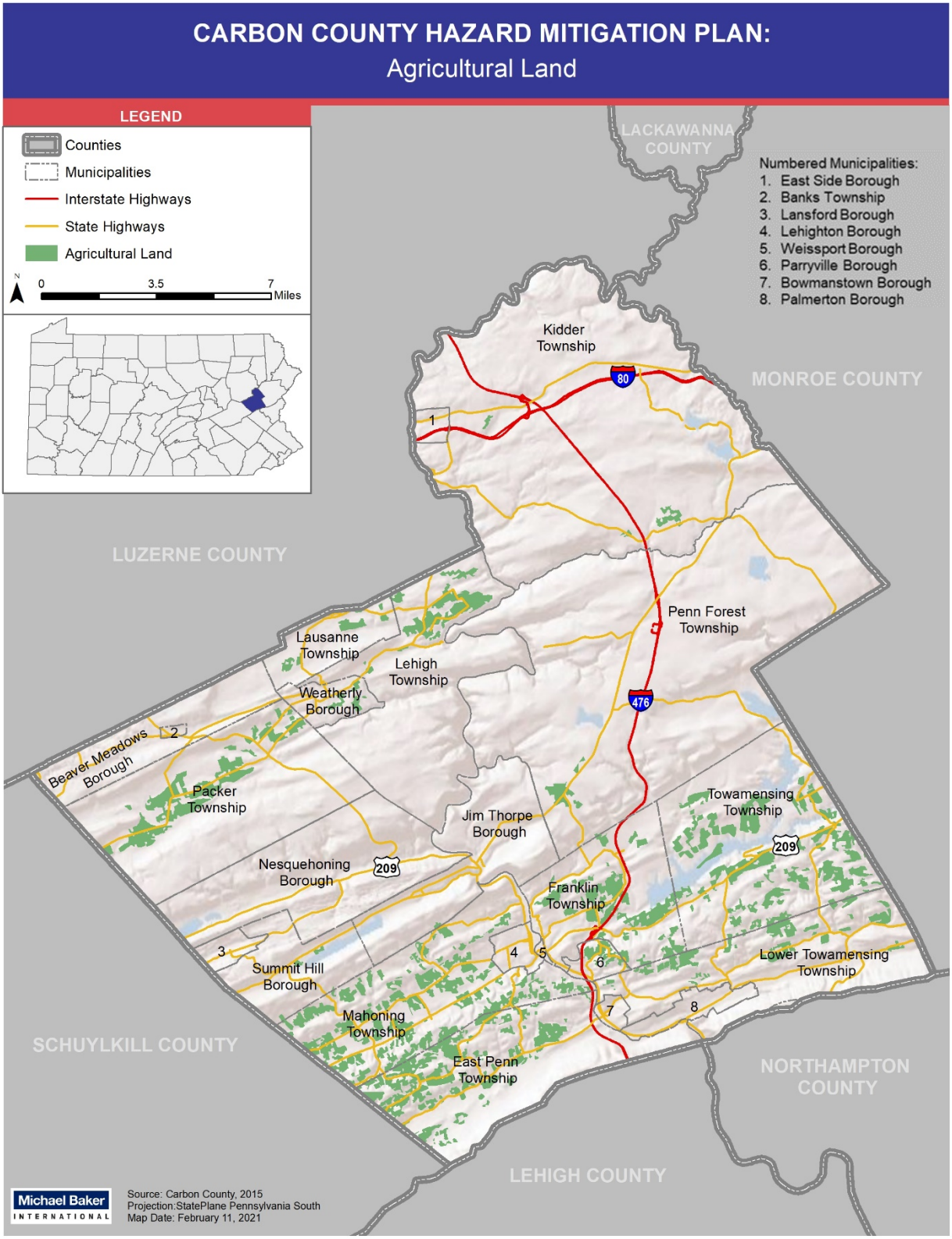
There are two types of droughts that are of concern in Carbon County; hydrologic and water management (as categorized by the World Meteorological Organization). A hydrologic drought is defined in terms of reduction of stream flows, reduction in lake or reservoir storage and lowering of groundwater levels. This results from a shift in normal weather patterns over an area causing the amount of precipitation to fall significantly below the long-termed average. A water management drought is characterized as water deficiencies that exist due to failure of water management practices or facilities to bridge normal or abnormal dry periods and equalized water supply throughout the year. Pennsylvania has faced and will continue to face both types of droughts.

4.3.1.1. Location and Extent

Droughts are regional climatic events, so when these events occur in Carbon County, impacts are felt across the entire County as well as areas outside County boundaries. The spatial extent for areas of impact can range from areas of Pennsylvania to the entire mid-Atlantic region. Locations of droughts nationwide are monitored continuously by USGS, and the PA DEP monitors conditions throughout Pennsylvania. Maps showing locations currently experiencing drought conditions are posted on various websites (including http://waterwatch.usgs.gov) and show locations where stream flow is below normal and where drought conditions exist or are emerging.

Areas with extensive agricultural land use can experience particularly significant impacts. As shown in Figure 4.3.1-1, these areas are primarily located in the southern portion of Carbon County.

FIGURE 4.3.1-1 CARBON COUNTY AGRICULTURAL LAND USE, 2021



4.3.1.2. Range of Magnitude

Droughts can have varying effects, depending upon what month they occur, as well as the severity, duration, and location of the event. Even short-term droughts can be devastating, especially in conjunction with extreme temperatures.

Hydrologic drought events result in a reduction of stream flows, reduction of lake/reservoir storage, and reduced groundwater levels. These events have a significant adverse impact on public water supplies for human consumption, rural water supplies for livestock consumption and agricultural operations, water quality, natural soil water or irrigation water for agriculture, soil moisture, and water for navigation and recreation. Drought can also create conditions conducive to wildfire events.

The Commonwealth uses five parameters to assess drought conditions:

1) Stream flows (compared to benchmark records)
2) Precipitation deficits (measured as the departure from normal, 30-year average precipitation)
3) Reservoir storage levels in a variety of locations (especially three New York City reservoirs in upper Delaware River Basin)
4) Groundwater elevations in a number of counties (comparing to past month, past year, and historic record)
5) The Palmer Drought Severity Index (PSDI) – a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature (see Table 4.3-1).

TABLE 4.3.1-1 PALMER DROUGHT SEVERITY INDEX CLASSIFICATIONS (NOAA, 2021A).

SEVERITY CATEGORY	PSDI 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

In Pennsylvania, PEMA has primary responsibility for managing droughts with direct support from the DEP. According the Drought Management in Pennsylvania (2012), PEMA and DEP use the following three stages to describe and manage droughts. They are listed below in order of increasing severity:

- Drought Watch: A period to alert government agencies, public water suppliers, water users and the public regarding the potential for future drought-related problems. The focus is on increased monitoring, awareness and preparation for response if conditions worsen. A

request for voluntary water conservation is made. The objective of voluntary water conservation measures during a drought watch is to reduce water uses by 5 percent in the affected areas.

- Drought Warning: This phase involves a coordinated response to imminent drought conditions and potential water supply shortages through concerted voluntary conservation measures to avoid or reduce shortages, relieve stressed sources, develop new sources, and if possible forestall the need to impose mandatory water use restrictions. The objective of voluntary water conservation measures during a drought warning is to reduce overall water uses by 10-15 percent in the affected areas.
- Drought Emergency: This stage is a phase of concerted management operations to marshal all available resources to respond to actual emergency conditions, to avoid depletion of water sources, to assure at least minimum water supplies to protect public health and safety, to support essential and high priority water uses and to avoid unnecessary economic dislocations. It is possible during this phase to impose mandatory restrictions on non-essential water uses that are provided in the Pennsylvania Code (Chapter 119), if deemed necessary and if ordered by the Governor of Pennsylvania. The objective of water use restrictions (mandatory or voluntary) and other conservation measures during this phase is to reduce consumptive water use in the affected area by 15 percent, and to reduce total use to the extent necessary to preserve public water system supplies, to avoid or mitigate local or area shortages, and to assure equitable sharing of limited supplies.

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

Droughts can have adverse effects on farms and other water-dependent industries. This can result in local economic loss. From a citizen's perspective, public safety is an issue in terms of consumable water not being available, as well as water for fire protection and emergency services.

Environmental impacts of drought include:

- Hydrologic effects – lower water levels in reservoirs, lakes and ponds; reduced stream flow; loss of wetlands; estuarine impacts; groundwater depletion and land subsidence; effects on water quality such as increases in salt concentration and water temperature
- Damage to animal species – lack of feed and drinking water; disease; loss of biodiversity; migration or concentration; and reduction and degradation of fish and wildlife habitat
- Damage to plant communities – loss of biodiversity; loss of trees from urban landscapes and wooded conservation areas
- Increased number and severity of fires, which is of higher concern in Carbon County
- Reduced soil quality and erosion issues
- Air quality effects – dust and pollutants
- Loss of quality in landscape
- Loss of water for navigation and recreation

- Increase in nitrate levels which can have health impacts on pregnant women and children

A worst-case scenario for droughts occurred in 1985. The Governor declared a State of Drought Emergency from April until December in sixteen eastern Pennsylvania counties, including Carbon. The declaration placed mandatory restrictions on water use in the region and provided penalties for violators (CCEMA, 2009).

4.3.1.3. Past Occurrence

Declared drought status for Carbon County from November 1980 to February 2021 is shown in Table 4.3.1-2. Descriptions for drought status categories (i.e. *watch*, *warning*, and *emergency*) are included in Section 4.3.1.2. Seven Drought Emergencies have been declared in Carbon County since 1955. Carbon County has not had a declared drought since Spring 2002; however, some of the agricultural lands have experienced loss due to drought conditions, such as in 2010. Since the 2015 Plan Update, there have been two drought watches and one drought warning (PA DEP, 2021a). The 1980-1983 event resulted in $196,000,000 in damages to crops across the Commonwealth. Below average rainfall created shortages in a number of municipalities in 1988, 1991, 1992, 1995, 1999, and 2002. The Pennsylvania Department of Environmental Protection is the agency responsible for collecting drought information. Data for all counties in the Commonwealth is available for the years 1980 through 2021.

In the past, during times of below average rainfall some communities experienced problems with water supply, but in most cases, voluntary rationing worked as a temporary solution to the problem. During "drought watch" events, a voluntary five percent reduction in water usage is enacted. During state declared drought emergencies, mandatory restrictions have been put into effect, as occurred during the 1991, 1995, and 1999 droughts. Due to the high cost of meeting the surface water requirements of the Safe Drinking Water Act reauthorization enacted in 1986, most communities have developed adequate ground water sources and no longer experienced water deficiencies during periods of below average rainfall.

TABLE 4.3.1-2 CARBON COUNTY DECLARED DROUGHT STATUS FROM 1980 TO 2020 (PADEP, 2021A).

DATE	DROUGHT STATUS	DATE	DROUGHT STATUS
Nov 6, 1980 - Nov 18, 1980	Emergency	Mar 15, 1999 - Jun 10, 1999	Watch
Nov 19, 1980 - Apr 20, 1982	Emergency	Jun 10, 1999 - Jul 20, 1999	Warning
Nov 10, 1982 - Feb 8, 1983	Warning	Jul 20, 1999 - Sept 30, 1999	Emergency
Feb 8, 1983 - Mar 28, 1983	Warning	Sept 30, 1999 - May 5, 2000	Watch
Jan 23, 1985 - Apr 26, 1985	Warning	Nov 6, 2001 - Dec 5, 2001	Watch
Apr 26, 1985 - Dec 19, 1985	Emergency	Dec 5, 2001 - Feb 12, 2002	Warning
Jul 7, 1988 - Dec 12, 1988	Watch	Feb 12, 2002 - May 13, 2002	Emergency
Mar 3, 1989 - May 15, 1989	Warning	May 13, 2002 - Nov 7, 2002	Watch
Jun 28, 1991 - Jul 24, 1991	Watch	Apr 11, 2006 - Jun 30, 2006	Watch
Jul 24, 1991 - Apr 20, 1992	Emergency	Aug 8, 2007 - Sept 5, 2007	Watch
Apr 20, 1992 - Jun 23, 1992	Warning	Oct 5, 2007 - Jan 11, 2008	Watch
Sept 1, 1995 - Sept 20, 1995	Warning	Sept 16, 2010 – Nov 10, 2010	Warning

Sept 20, 1995 - Nov 8, 1995	Emergency	March 24, 2015 – July 10, 2015	Watch
Nov 8, 1995 - Dec 18, 1995	Warning	Aug 2, 2016 - Nov 3, 2016	Watch
Oct 27, 1997 - Jan 16, 1998	Warning	Nov 3, 2016 - Feb 14, 2017	Warning
Dec 3, 1998 - Dec 14, 1998	Watch	Feb 14, 2017 - Apr 6, 2017	Watch
Dec 14, 1998 - Mar 15, 1999	Warning		

Carbon County also has record of a drought events prior to 1980. In 1963 a Gubernatorial Proclamation was issued for numerous communities in the Commonwealth in response to drought. In 1964, two boroughs in Carbon County (Jim Thorpe and Weatherly) were affected by a drought. No drought declarations were issued by the Governor; however, emergency equipment was furnished to the two boroughs from the emergency stockpile at Fort Indiantown Gap (CCEMA, 2009). This included emergency generators and filtering systems since emergency sources of water had to be tapped and purified. In 1965 a presidential disaster declaration was issued for the Delaware River Basin.

Table 4.2-1 shows that since 1955, there has been one Presidential Disaster Declaration issued (1965) in response to drought conditions within Carbon County.

During the 2021 Plan Update process, correspondence with Carbon County Emergency Management Agency showed that the County came close to entering a drought period. Figure 4.3.1-2 below shows a photograph of the 4th Hollow Reservoir in Nesquehoning Borough on October 8th, 2020. The water-level is regularly up to the green tree-line and has not been seen this low by those familiar with the area. The significant drop in water level showed that Carbon County may have been nearing a Drought Watch or Drought Warning status.

FIGURE 4.3.1-2 FOURTH HOLLOW RESERVOIR IN NESQUEHONING BOROUGH – OCTOBER 8, 2020 (CCEMA, 2020).

The U.S. Department of Agriculture (USDA) Risk Management Agency operates and manages the Federal Crop Insurance Corporation program. Since Carbon County farms are eligible for crop insurance, it is possible to determine agricultural losses due to drought in the County. Table 4.3.1-3 displays the crop loss insurance payments by year due to drought (including even mild drought occurrences) from 2004 through 2020. Based on these indemnity payment amounts, crop losses in 2018 were the highest followed by 2017.

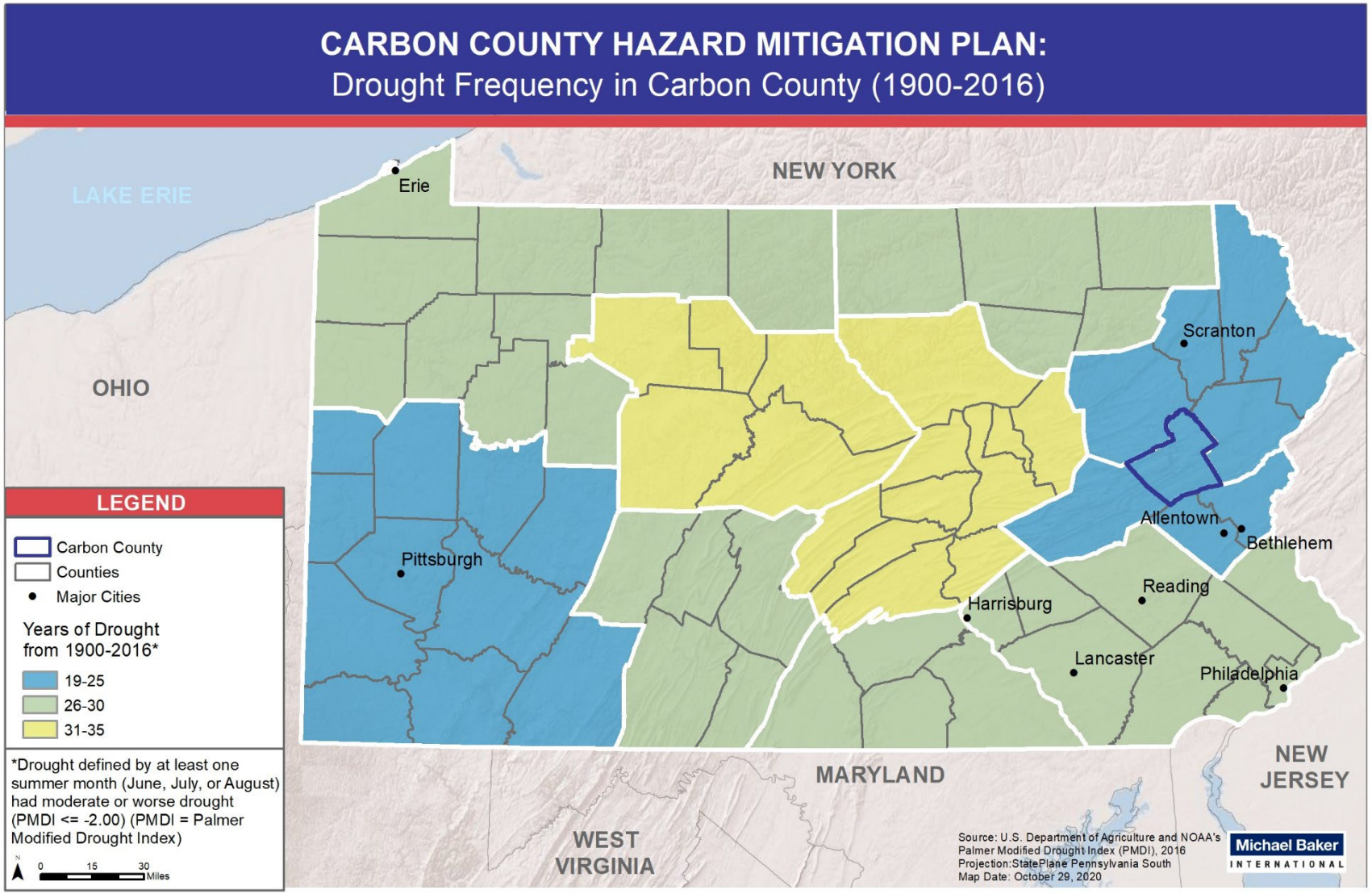
TABLE 4.3.1-3 CROP LOSS INSURANCE COMPENSATION DUE TO DROUGHT (USDA RMA, 2020A) (USDA RMA, 2020B).

CROP YEAR	INDEMNITY AMOUNT
2004	$12,391
2005	$97,833
2006	$81,407
2007	$118,333
2008	$90,761
2009	$31,806
2010	$41,254

CROP YEAR	INDEMNITY AMOUNT
2011	$162,488
2012	$39,129
2013	$21,175
2014	$277,696
2015	$277,184
2016	$372,821
2017	$601,752
2018	$1,188,139
2019	$77,809
2020 (as of 1/19/21)	$11,367

As discussed earlier, one way to measure the magnitude of a drought is through the PDSI. This index is based on several meteorological and hydrological factors, including temperature and soil moisture levels, and is computed weekly by NWS' Climate Prediction Center. The index compares precipitation received against the average amount expected during that period. Droughts are expressed as negative numbers. Palmer values of -2.00 to -2.99 indicate a watch status; values of -3.00 to -3.99 indicate a warning; and values of -4.00 and less indicate an emergency. According to Figure 4.3.1-3, Carbon County has experienced between 19-25 years with recorded droughts as of 2016. A drought year is defined by at least one summer month with a moderate to extreme drought. As shown on the map, parts of northeastern and southwestern Pennsylvania, including Carbon County, experienced the fewest drought years across the Commonwealth. This is the best data available at the time of this Plan Update.

FIGURE 4.3.1-3 PSDI FOR CARBON COUNTY, 2016



4.3.1.4. Future Occurrence

It is difficult to forecast the severity and frequency of future drought events in Carbon County. Based on national data from 1900 to 2016, Carbon County experienced droughts between 19 and 25 years during the timeframe (see Figure 4.3.1-3). This map captures droughts with a PDSI of -2.00 or less. Carbon County has experienced droughts in the past and the potential exists for the County to experience droughts in the future. Additionally, increases in water usages and leakage may result in an increased deficiency in coming years. Therefore, the probability of a drought impacting Carbon County is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

Serious hydrological droughts or supply deficiencies are expected in the future, especially during periods of drought, as continued growth in population, increased demand for water from industry, and the effects of land development (which tends to reduce the water table) increase demand. The regions around Wilkes-Barre and Allentown are both projected to experience an increase in heatwaves by 2050, in addition to warmer conditions and doubling in intensity in this time frame according to Climate Central. The organization also projects the regions will experience droughts more than two times the current amount and intensity by 2050 (Climate Central, 2019). With these projections, it is anticipated that the region could become more vulnerable to drought events in the future.

4.3.1.5. Vulnerability Assessment

The most significant losses resulting from drought events are typically found in the agriculture sector. In 1999 a Gubernatorial Proclamation was issued in part due to significant crop damage. Preliminary estimates by the United States Department of Agriculture (USDA) indicated possible crop losses across the Commonwealth in excess of $500 million. This estimate did not include a 20 percent decrease in dairy milk production which also resulted in million-dollar losses (NOAA NCEI, 2021). While these were statewide impacts, they illustrate the potential for droughts to severely impair the local economy, especially since a prolonged drought can negatively impact the livelihood of residents within agricultural communities. Prime farmlands in Carbon County will be more susceptible to risks from drought, as will public and private water supplies.

According to the 2017 US Department of Agriculture's Census of Agriculture, Carbon County ranks 58th out of the 67 Commonwealth counties in agricultural production. There were 200 farms in Carbon County, with 19,498 acres of land in farms (an average farm size of 97 acres). The market value of all products sold was $13 million; 88% of that value was derived from crop sales (USDA, 2017). Prime farmland in Carbon County is illustrated in Figure 4.3.1-1.

Carbon County residents that use private domestic wells are more vulnerable to droughts because their drinking water can dry up. Table 4.3.1-4 lists the number of domestic wells per municipality. The total number of wells in Carbon County has increased slightly since the last update of the HMP from 6,104 domestic wells in 2015 to 6,339 in 2020. It is important to note that the well data was obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS relies on voluntary submissions of well record data by well drillers therefore it is not a complete database of all domestic wells in the County. This is the only comprehensive data set of domestic wells available.

TABLE 4.3.1-4 NUMBER OF DOMESTIC WELLS PER MUNICIPALITY IN CARBON COUNTY (PAGWIS, 2021).

MUNICIPALITY	DOMESTIC WELLS
Banks Township	0
Beaver Meadows Borough	2
Bowmanstown Borough	4
East Penn Township	251
East Side Borough	12
Franklin Township	335
Jim Thorpe Borough	220
Kidder Township	657
Lansford Borough	4
Lausanne Township	20
Lehigh Township	39
Lehighton Borough	15
Lower Towamensing Township	243
Mahoning Township	456
Nesquehoning Borough	49
Packer Township	99
Palmerton Borough	11
Parryville Borough	14
Penn Forest Township	3,221
Summit Hill Borough	46
Towamensing Township	628
Weatherly Borough	11
Weissport Borough	1
Unknown	56
Total	6,394

Public water suppliers are also vulnerable in periods of drought, particularly if they rely on groundwater wells and do not have backup water storage. As of 2021, there were 12 public water suppliers in the County. These include three municipal run water suppliers, six authorities, one joint authority, and two water associations. Figure 4.3.1-4 displays the water suppliers in the County and Table 4.3.1-5 includes the details about these water suppliers and their water source.

FIGURE 4.3.1-4 PUBLIC WATER SUPPLIERS IN CARBON COUNTY

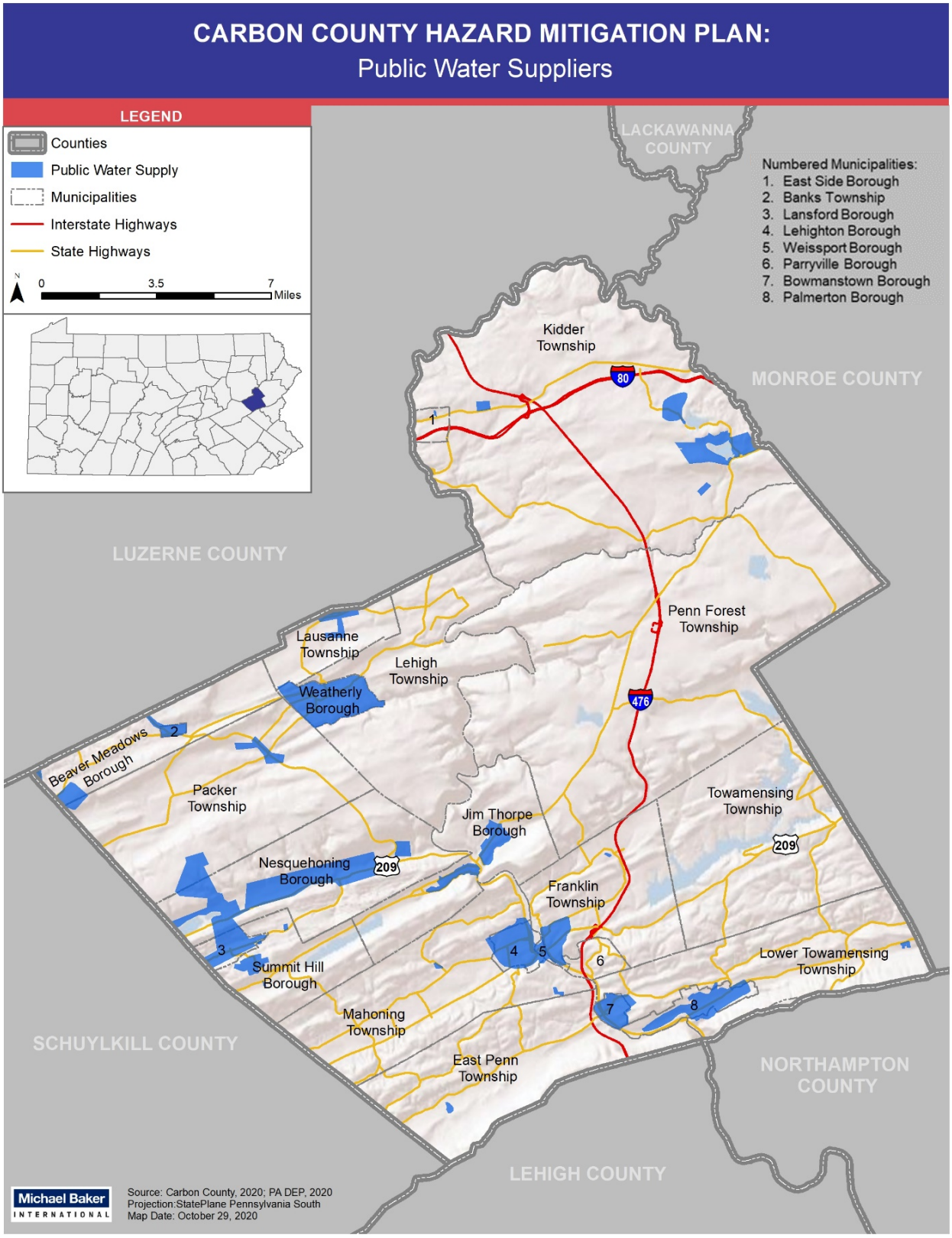


TABLE 4.3.1-5 PUBLIC WATER SERVICE IN CARBON COUNTY (PA DEP, 2021B)

NAME	OWNERSHIP	GROUNDWATER SOURCE	SURFACE WATER SOURCE
Aqua PA Golden Oaks Development	Private Investor Owned	Yes	No
Beaver Meadows Municipal Authority	Authority	No	No
Beaver Run Water Association	Association	Yes	No
Blue Heron Homeowners Association	Private Investor Owned	Yes	No
Blue Mountain View	Mobile Home Park	Yes	No
Bowmanstown Borough Authority	Authority	Yes	No
Carbon County Corrections	Institutional Correctional	Yes	No
Chestnut Ridge Mobile Home Park	Mobile Home Park	Yes	No
Creekside Manor Mobile Home Park	Mobile Home Park	Yes	No
DS Water Co.	Private Investor Owned	Yes	No
Jim Thorpe Borough Water East	Municipal	Yes	No
Jim Thorpe Borough Water West	Municipal	No	Yes
Lansford-Coaldale Joint Water Authority	Authority	Yes	No
Lehighton Municipal Water Authority	Authority	Yes	Yes
Mahoning Valley Nursing and Rehabilitation Center	Institutional Health	Yes	No
McAdoo Industrial Park (CAN DO Inc.)	Private Investor Owned	Yes	No
Midlakes Water System	Private Investor Owned	Yes	No
Nesquehoning Borough Authority	Authority	Yes	Yes
Nis Hollow Estates Mobile Home Park	Mobile Home Park	Yes	No
Northside Heights Estates	Mobile Home Park	Yes	No
Palmerton Municipal Water Authority	Authority	Yes	Yes
Springhill Mobile Home Park	Mobile Home Park	Yes	No
Summit Hill Municipal Water Authority	Authority	Yes	No
Summit Management and Utilities	Association	Yes	No
Weatherly Borough	Municipal	Yes	No
Weiner Mobile Estates	Mobile Home Park	Yes	No

4.3.2. Flood, Flash Flood, Ice Jam

4.3.2.1. 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 natural hazards in Pennsylvania. Flooding occurs when excess water from snowmelt or rainfall fills a stream, causing it to overflow onto the stream banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods.

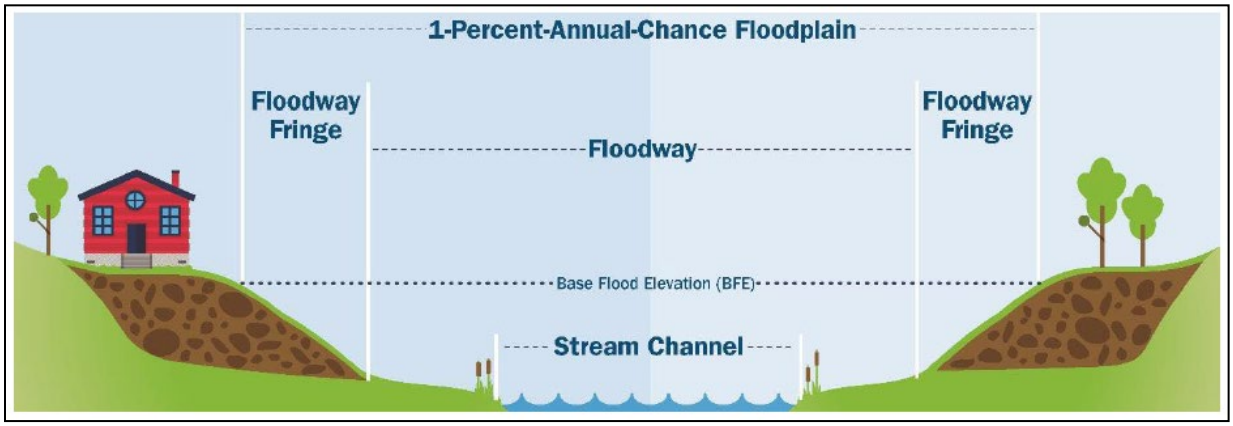
Flash flood conditions can result from a large amount of rainfall over a short time span. Though, a small amount of rain can also result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impervious surfaces such as large parking lots, paved roadways, or other densely developed areas.

Snow melt combined with heavy rains can cause frozen rivers to swell, which can break the ice layer on top of a river. If this occurs, large chunks can float downstream piling up in narrow passages and near other obstructions such as bridges and dams causing an ice jam.

Carbon County is located in the Upper Lehigh River Watershed, a sub-watershed in the greater Delaware River Watershed (Carbon County, 2018). This area, like many others in Pennsylvania, is flood prone because of the mountainous terrain and because most of the communities are located along streams and river valleys. In addition, development of the floodplain has resulted in frequent flooding. For inland areas, excess water from snowmelt or rainfall accumulates and overflows onto stream banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods.

The size of the floodplain is described by the recurrence interval of a given flood. Flood recurrence intervals are explained in more detail in Section 4.3.2.4. However, in assessing the potential spatial extent of flooding it is important to know that a floodplain associated with a flood that has a 1-percent-annual chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2-percent-annual chance of occurring. The National Flood Insurance Program (NFIP), for which the Flood Insurance Rate Map (FIRM) is published, identifies the risk associated with the 1-percent-annual chance flood. This 1-percent-annual chance flood event is used to delineate the Special Flood Hazard Area (SFHA) and identify Base Flood Elevations (BFE), terms identified in Figure 4.3.2-1. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth, and the County when determining flood risk.

FIGURE 4.3.2-1 DIAGRAM IDENTIFYING SPECIAL FLOOD HAZARD AREA, FLOODWAY, AND FLOOD FRINGE



Countywide FIRMs were published for Carbon County on June 3, 2002. All communities within the County are now shown on a single set of countywide FIRMs. An example of the mapping products published is shown in Figure 4.3.2-2, which illustrates flood hazard areas along the Lehigh River and Nesquehoning Creek in Jim Thorpe Borough. FEMA is currently in the process of conducting updated engineering models and field surveys in order to update the Countywide FIRM. The current Flood Insurance Study (FIS) report was published for Carbon County on June 3, 2002. This remains the most recent flood hazard data, which was used to update this flood hazard profile. The FIRM and FIS for the entire County can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov). These maps can be used to identify the expected spatial extent and elevation of flooding from a 1% and 0.2%-annual-chance flood event. Twenty-two of the twenty-three municipalities in the County were determined to have special flood hazard areas (SFHA). Beaver Meadows Borough does not have any SFHA.

FIGURE 4.3.2-2 FIRM PANEL 42025C0144, EFFECTIVE JUNE 3, 2002, SHOWING FLOOD HAZARD AREAS ALONG THE LEHIGH RIVER AND NESQUEHONING CREEK IN JIM THORPE BOROUGH.

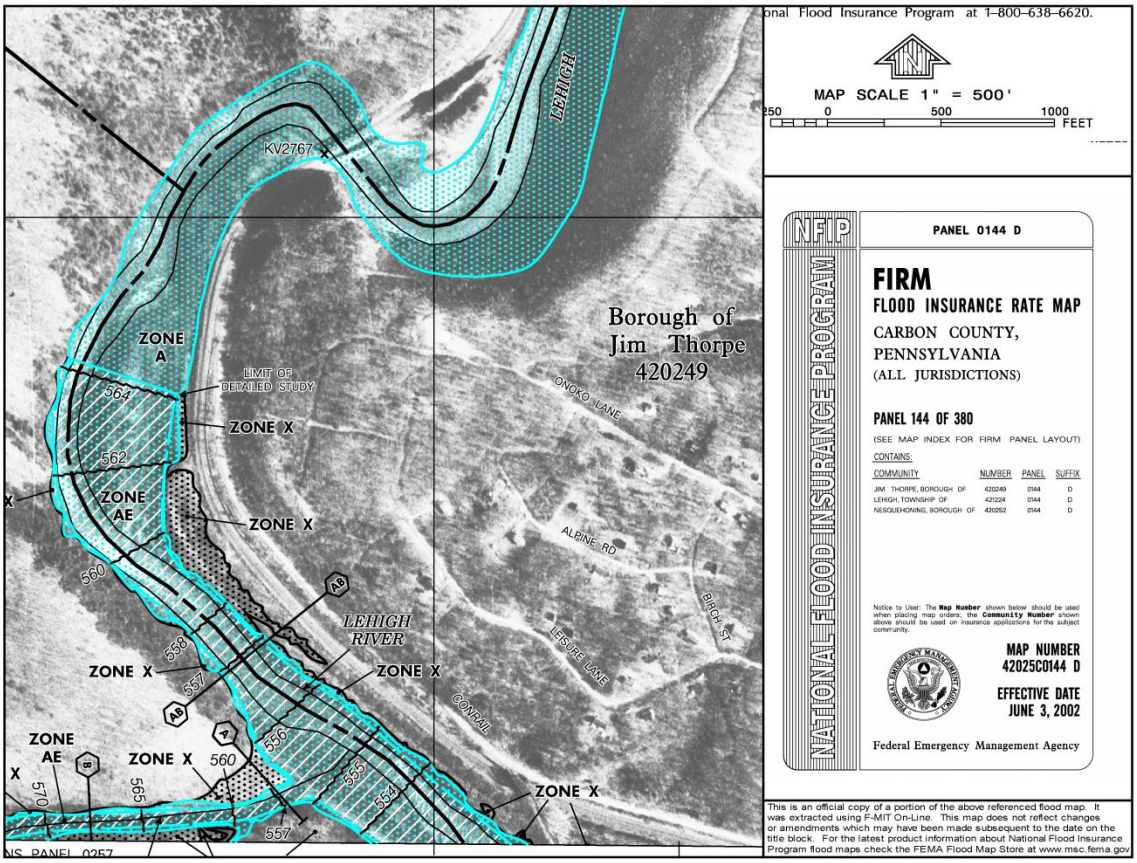


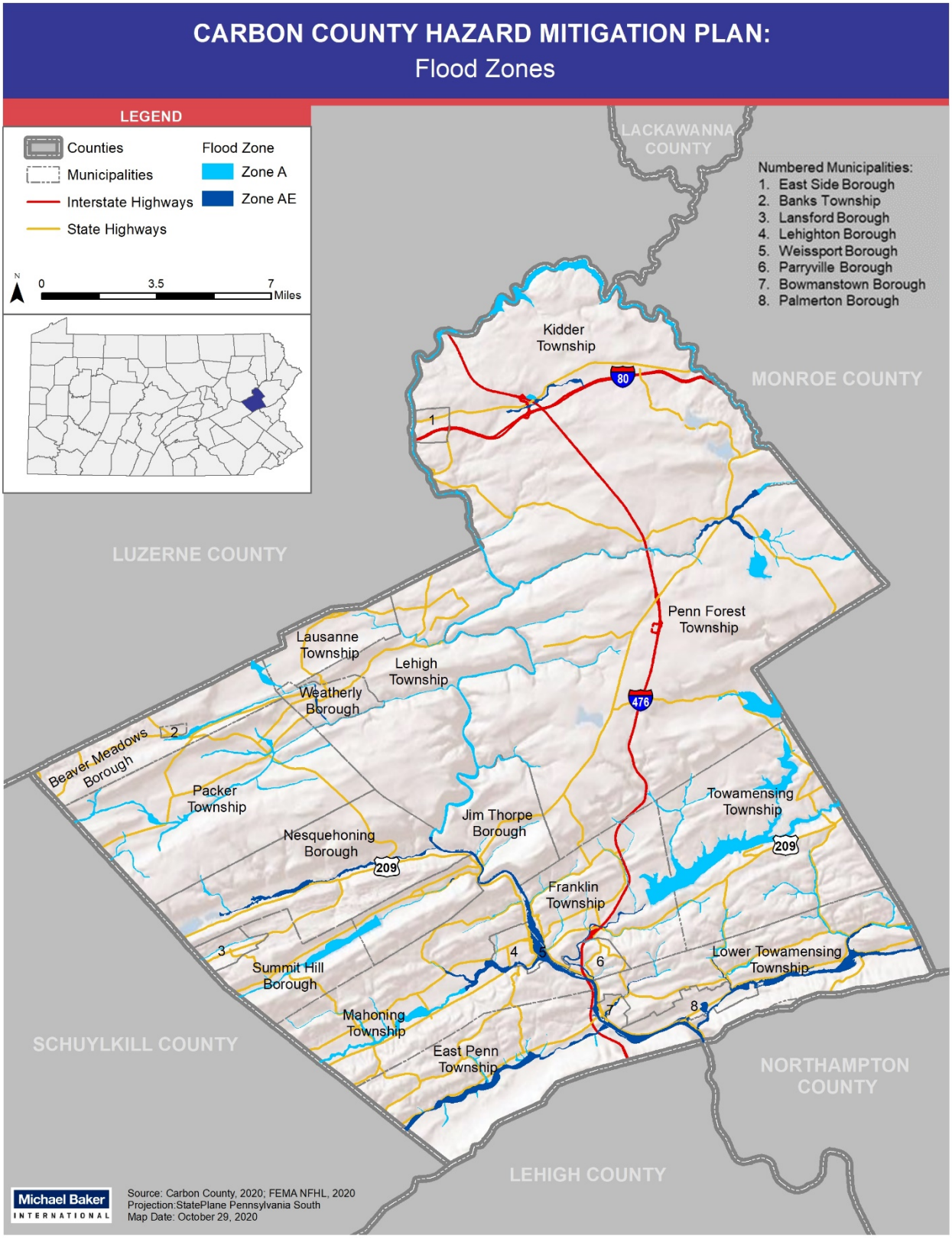
Figure 4.3.2-3 shows the flood zones in Carbon County. The location of approximate and detailed (including Base Flood Elevations) Special Flood Hazard Areas (1%-annual-chance zones) are shown. FEMA defines Flood Zone A as the areas of approximate 1%-annual-chance zones, since Base Flood Elevation data is not known for the area, and Zone AE shows areas in the 1%-annual-chance zones determined by Base Flood Elevation details.

The countywide FIS conducted by FEMA identifies areas of principal flood problems (FEMA, 2002). All streams studied in the report present varying degrees of flood risk in the County. Large magnitude floods occurred on the Lehigh River in 1902, 1955, 1956, and 1969. Floods along the Lehigh River have been more controllable after the Francis E. Walter Dam was completed in February 1961. However, releases from Beltzville Dam since February 1971 have effected control measures possible for the County. Additional significant flood areas include Mahoning Creek, Aquashicola Creek, and Much Chunk Creek. Major storms can cause localized inundation of structures along streams and creeks across the County including: Aquashicola Creek, Black Creek, Buckwha Creek, Dilldown Creek, Fireline Creek, Hazle Creek, Lehigh River, Lizard Creek, Mahoning Creek, Mauch Chunk Creek, Mill Creek, Mud Run, Nesquehoning Creek, Park Run, Pohopoco Creek, and Stewart Creek.

It should also be noted that flooding is not only caused by heavy rain events. Additionally, as described in the Dam Failure Hazard Profile in Appendix H, Carbon County has 15 high-hazard dams located within the County. If any one of these dams were to fail, there could be

loss of life and property damage resulting from flooding within the dam inundation areas. Flood risk is also associated with levee failure. The United States Army Corps of Engineers (USACE) identifies one levee system in Carbon County through the National Levee Database (USACE, 2021a). The Weissport Levee System runs 0.94 miles along the Lehigh River in Weissport Borough. More details about Levee Failure are included in Section 4.3.16.

FIGURE 4.3.2-3 FLOOD ZONES THROUGHOUT CARBON COUNTY.



4.3.2.2. Range of Magnitude

Flooding in Carbon County has mainly been caused by heavy rainfall. Some areas have experienced rain events bringing more than three to as many as eight inches of rain to the area within a day. In Caron County, there are seasonal differences in how floods are caused. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds, although the snowpack is generally moderate during most winters. Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms deposit large quantities of rainfall over a short period of time that can result in flash flood events. In addition, as detailed in Section 4.3.4, the County occasionally experiences intense rainfall from tropical storms in late summer and early fall.

Floods are the most prevalent type of natural disaster occurring in the Commonwealth of Pennsylvania. Pennsylvania is one of the most flood-prone states in the nation. From rural areas to suburban communities, floods (especially flash floods) are a constant concern. Floods, seasonal or flash, have been the cause of millions of dollars in annual property damages, loss of lives, and disruption of economic activities. The Commonwealth of Pennsylvania leads the nation on flood related losses. Floodplain management, flood control structures, and flood relief funds are strategies that have reduced the Commonwealth's annual flood damages significantly, but these structures cannot completely protect all existing and future flood plain development.

The impacts due to flooding, in terms of injuries, damages, and death, can vary in degrees from minor to catastrophic (PAHMP 2018):

- Minor – Very few injuries, if any. Only minor property damage & minimal disruption on quality of life. Temporary shutdown of critical facilities.
- 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.
- 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.
- 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.

Floods are considered hazards when people and property are affected. Injuries and deaths can occur when people are swept away by flood currents or bacteria and disease are spread by moving or stagnant floodwaters. Most property damage results from inundation by sediment-filled water. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots and paved roadways. Additionally, heavy rainfall on loose soil or sloped areas can lead to landslide events. Landslides can lead to substantial property damage; this hazard is described in detail in Section 4.3.5.

Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover and rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. Since the County has mountainous terrain as a part of the Pocono Mountain region, this can contribute to more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain. Also, erosion can occur following conversion of natural vegetation to agricultural land. Soil carried away in rain and

irrigation water can lead to sedimentation and decreased stream capacity which can increase flooding. Flooding can also be exacerbated through the process of urbanization. Increased development of impermeable surfaces in buildings and pavement or lack or appropriately sized flood water detention basins leads to localized flooding.

A worst-case scenario flash flood occurred on June 20, 2006 when several days of heavy rain throughout the Lehigh River Basin culminated with flooding along the main stem of the Lehigh River, causing Carbon County to be declared a disaster area. About 130 homes, 15 businesses and 80 bridges, culverts, and roads in the County were damaged from the flood. Storm event totals for the County averaged eight to fifteen inches of rainfall.

Although floods can cause damage to property and loss of life, floods are naturally occurring events that benefit riparian systems. Such benefits include groundwater recharge and the introduction of nutrient rich sediment improving soil fertility. However, the destruction of riparian buffers through development, changes to land use and land cover throughout a watershed, and the introduction of chemical or biological contaminants which often accompany human presence cause environmental harm when floods occur. Hazardous material facilities are potential sources of contamination during flood events. Other negative environmental impacts of flooding include water-borne diseases, heavy siltation, damage or loss to crops, and drowning of both humans and animals.

Dams, levees, and reservoirs act as flood protection measures. There are 56 dams in the County; however, 15 of these are high hazard dams. Please refer to the Dam Failure hazard profile in Appendix H for more information on dams. Levee systems can also act as flood protection measures when continually maintained and evaluated. There is one levee system in Carbon County. Please refer to the Levee Failure hazard profile in Section 4.3.16 for more information on levees.

In addition to flood protections for dams and levees, protection measures have been built up through various regulations and physical projects across the County. Bowmanstown Borough completed Lime Street to provide emergency access to the Meadowcrest Subdivision in a series of emergency weather events. The borough is in the process of extending pipes at the Franklin and Fireline Road culvert to a nearby stream in order to prevent flooding. Franklin Township notes that drainage improvement projects on Red Hill Road and Evergreen Road are underway which will prevent washouts during heavy rain. Jim Thorpe Borough is working on installing, replacing, and repairing culverts previously identified as problem areas throughout the Borough.

4.3.2.3. Past Occurrence

Carbon County has a long history of flooding events. Flash flooding is the most common type of flooding that occurs in the County. Nine of the seventeen Presidential Disaster and Emergency Declarations affecting Carbon County have been in response to hazard events related to flooding (see Table 4.2-1). Table 4.3.2-1 lists flood event information from 1993 to 2020 obtained from the NCEI. The NCEI estimates that during this timeframe, the County experienced over $5.1 million of property damage from flooding events. Other years with major flooding events prior to 1993 include 1933, 1935, 1936, 1942, 1946, 1955, 1967, 1971, and 1977 (CCEMA, 2009).

In Carbon County there are seasonal differences in how floods are caused. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds. Winter floods have also resulted from

runoff of intense rainfall on frozen ground, and, on rare occasions, local flooding has been exacerbated by ice jams in rivers. Ice jam floods occur on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur. Flood events caused by ice jams are limited primarily to the Lehigh River. Although specific data on ice jam incidents in the County is not available from the CCEMA or the National Center for Environmental Information (NCEI), anecdotal evidence from county and municipal officials suggests that ice jams have occurred in the past on the river. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) serves as a science and engineering research branch of the U.S. Army Corp of Engineers (USACE) to solve problems related to complex environments. The CRREL notes two ice jams that were recorded in Carbon County, included in Figure 4.3.2-4. Details pertaining to these events such as date and impact are not available.

Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms deposit large quantities of rainfall over a short period of time that can result in flash flood events. Figure 4.3.2-5 includes the historical reports of flash floods in Carbon County. Flash flood events have occurred throughout the County. In addition, Carbon County occasionally experiences intense rainfall from tropical storms in late summer and early fall.

Before the construction of Mauch Chunk Creek Dam in 1969-72, significant flood damage was a frequent occurrence in Jim Thorpe Borough. Ten major floods have been recorded within a period of 160 years, leading to almost 200 deaths. These include floods in 1831, 1841, 1901, 1902, 1933, 1942, and 1955 (Kraus, 1989).

The flood in 1942 displaced hundreds of residents in Weissport Borough who were without food, residence, and fuel. Because flood waters moved so quickly, many people lost all food and supplies as they were swept away or damaged. Residents were taken care of in a shelter set up by the Carbon County chapter of the American Red Cross. Additionally, the Panther Valley Mines were flooded, stopping coal operations for over a week and leaving many without daily work (The Morning Call, 1942).

Significant snowmelt in late January 2019 led to a series of road closures in Carbon County. Road closures due to flooding were reported in East Penn Township, Lower Towamensing Township, and Mahoning Township (FOX56, 2020).

On August 4, 2020, Tropical Storm Isaias tracked through eastern Pennsylvania. The storm caused flooding throughout Carbon County, particularly along Aquashicola Creek. Palmerton Borough was forced to evacuate some of its residents. Floods caused road closures, led to damage in back yards, and downed trees and power lines. One resident noted they had not seen floodwaters that high since 2011 when Hurricane Irene hit. The next day fire crews in Palmerton Borough were pumping water from residents' basements after the stormwater system was overloaded (Reber, 2020).

FIGURE 4.3.2-4 ICE JAM REPORTS IN CARBON COUNTY.

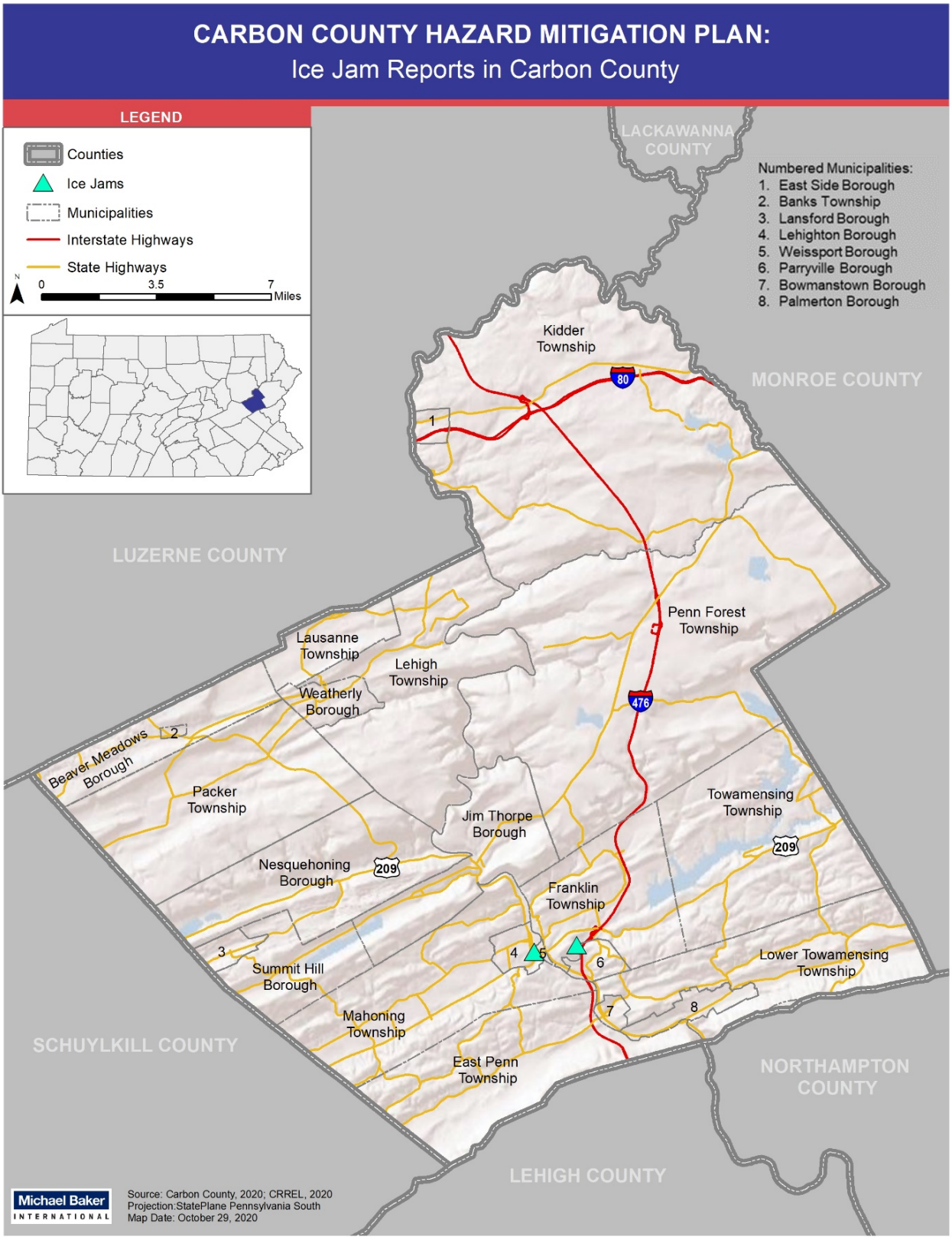


TABLE 4.3.2-1 FLOOD AND FLASH FLOOD EVENTS IMPACTING CARBON COUNTY FROM 1996-2020 (NOAA NCEI, 2021).

DATE	LOCATION & DESCRIPTION
1/19/1996	Multiple Counties. Flood/Flash Flood – All of Pennsylvania was declared a disaster area. Seventeen of 23 townships reported flood damage. In all 365 homes suffered major flood damage and 1,185 suffered minor flood damage. In addition 6 apartment buildings, 13 businesses, 34 roads, 51 sewer lines, 13 electrical systems and 3 parks were damaged by the flooding.
1/27/1996	Multiple Counties. Flood.
4/16/1996	Countywide. Flash Flood.
10/19/1996	Countywide. Flood - Heavy rain caused considerable highway and poor drainage flooding as well as flooding of some of the smaller creeks in Carbon County.
11/8/1996	Countywide. Flash Flood.
12/2/1996	Countywide. Flash Flood.
9/11/1997	Mahoning Township. Flood – Thunderstorms with heavy rain caused flooding along the tributaries of the Mahoning Creek within Mahoning Township.
6/21/1998	Southern Carbon County. Flash Flood - Nearly stationary thunderstorms with torrential downpours caused flash flooding in the southern part of Carbon County.
9/16/1999	Multiple Counties. Flash Flood – Hurricane Floyd caused widespread flash flooding throughout many Counties in the Commonwealth.
7/30/2000	Southeastern Carbon County. Flash Flood.
12/17/2000	Countywide. Flood - Widespread heavy rains of between 2.5 and 4.0 inches fell across the entire southern Poconos with Carbon County bearing the brunt of the flooding.
8/3/2001	Southwestern Carbon County. Flash Flood - Thunderstorms with torrential downpours caused flash flooding that damaged a bridge in East Penn Township.
6/19/2002	Northwestern Carbon County. Flash Flood.
6/26/2002	Northeastern Carbon County. Flood.
7/23/2002	Northeastern Carbon County. Flash Flood.
6/12/2003	Central and Eastern Carbon County. Flash Flood - A thunderstorm with torrential downpours caused flash flooding across east central Carbon County. Doppler Radar storm total estimates were between 3 and 4 inches, most of which fell within one hour.
6/20/2003	Countywide. Flood - Heavy rain led to poor drainage flooding and flooding of streams in the county.
6/22/2003	Countywide. Flood.
8/5/2003	Southern Carbon County. Flash Flood - Thunderstorms with torrential downpours caused flash flooding of streams in extreme southern Carbon County and extreme northern Lehigh County.
8/6/2003	Northern Carbon County. Flash Flood - Nearly stationary thunderstorms dropped a Doppler Radar storm total estimate of between 3 and 5 inches in western parts of Kidder Township and caused flooding along smaller streams including the Fawn Run.
9/23/2003	Multiple Counties. Flood - The heavy runoff led to flooding along the Aquashicola Creek and down county along the Lehigh River.
9/18/2004-09/19/2004	Countywide. Flash Flood – Remnants from Hurricane Ivan Storm caused heavy rain. Storm totals average around 5 inches and caused poor drainage, creek and river flooding throughout Carbon County. A 44-year-old man drowned. President George W. Bush declared the county a disaster area. Eighty-nine homes and four businesses were damaged. Seven public buildings and structures were damaged.

DATE	LOCATION & DESCRIPTION
3/29/2005	Countywide. Flood.
4/2/2005	Countywide. Flood - The Mahoning Creek flooded in Lehighton and Mahoning Township. Pennsylvania State Route 443 was closed across Mahoning Township. Flooding along Lizard Creek in East Penn Township forced the closure of Pennsylvania State Route 895. Property damage was limited to basement flooding.
10/8/2005	Countywide. Flood.
5/30/2006	Northern Carbon County. Flash Flood.
6/1/2006	Nesquehoning. Flash Flood - Thunderstorms with torrential rains caused creek flooding in western Carbon County. Creeks overflowed across a few roadways in Lansford. Water accumulated up to three feet on some roadways in Lansford.
6/27/2006	Multiple Counties. Flash Flood - Several days of heavy rain throughout the Lehigh River Basin culminated with flooding along the main stem of the Lehigh River. President George W. Bush declared Carbon County a disaster area. Event totals in Carbon County averaged eight to twelve inches. In Carbon County about 130 homes, 15 businesses and 80 bridges, culverts and roads were damaged.
11/16/2006	Franklin and Penn Forest Townships, Beaver Meadows Borough. Flash Flood - Runoff from heavy rain led to flooding of streams in the central part of Carbon County in Franklin and Penn Forest Townships and also in Beaver Meadows Borough in the northwest part of the county.
3/2/2007	Multiple Counties. Flood.
4/15/2007	Eastern Carbon County. Flood.
8/25/2007	Lehighton. Flash Flood.
6/14/2008	Albrightsville. Flash Flood.
12/12/2008	Lehighton. Flood.
6/13/2009	Summit Hill. Flash Flood.
7/29/2009	Christmans. Flash Flood.
8/12/2009	Hickory Run. Flash Flood.
10/1/2010	Bowmanstown. Flood - A series of low pressure systems that moved north along a slowly moving cold front brought heavy rain into Eastern Pennsylvania.
3/10/2011	Lehighton. Flood - Flooding along the Mahoning Creek covered walking paths in the Bear Creek Memorial Park. The Lehigh River at Lehighton had moderate flooding and was above its 10 foot flood stage.
4/28/2011	Weissport. Flash Flood - Thunderstorms with heavy rain caused flash flooding in Lehighton. Water rescues occurred along Pennsylvania State Route 248. No serious injuries were reported.
8/7/2011	Germans. Flash Flood - Thunderstorms with heavy rain caused flash flooding along the Lizard Creek in East Penn Township. Pennsylvania State Route 895 was flooded by the creek and closed.
8/28/2011	Albrightsville. Flood - Tropical Storm Irene produced heavy flooding rain, tropical storm force wind gusts with hundreds of thousands of outages, moderate tidal flooding along the Delaware River.
8/28/2011	Beaver Meadows. Flash Flood – Tropical Storm Irene.
9/7/2011	Palmerton. Flood - The remnants of Tropical Storm Lee that interacted with a stalled frontal boundary produced several days with periods of heavy rain across Eastern Pennsylvania. Event precipitation totals averaged 4 to 9 inches.

DATE	LOCATION & DESCRIPTION
5/26/2012	Black Creek JCT. Flash Flood -Thunderstorms with torrential downpours caused flash flooding of smaller streams as well as poor drainage flooding in Nesquehoning Borough. The Wash Shanty Hill portion of U.S. Route 209 was closed because of significant water and debris runoff.
5/26/2012	Hauto. Flash Flood - Thunderstorms with torrential downpours caused flash flooding of smaller streams as well as extensive poor drainage flooding in Lansford and Summit Hill Boroughs and the northwest part of Mahoning Township. Roadways were closed and many basements were flooded
5/29/2012	Palmerton. Flash Flood - Thunderstorms with heavy rain caused poor drainage as well as creek flash flooding along the southern tier of Carbon County from Palmerton Borough through Lower Towamensing Township. The heavy rain caused a rock slide onto Maunch Chunk Road in Palmerton.
9/18/2012	Hauto. Flash Flood - Thunderstorms with heavy rain caused flash flooding and road closures across several locations in Carbon County.
6/28/2013	Normal. Flash Flood - Thunderstorms with very heavy rain caused poor drainage and small stream flash flooding in Carbon County from Lansford and Summit Hill Township east through Jim Thorpe.
7/2/2013	Trachsville. Flood - Event precipitation totals averaged 1 to 3 inches across southeast Carbon County
5/31/2015	New Mahoning. Thunderstorms with heavy rain caused flash flooding in and around Mahoning Township. Flooding was reported along SR 443 near the Mahoning Cree and 84 Lumber. 3.52 inches of precipiation were measured in Lehigton.
6/30/2015	Meckesville. A series of thunderstorms with very heavy rain caused flash flooding of smallerstreams and poor draining locations in central Carbon County from around Lehighton northeast through parts of Penn Forest and Towamensing Townships to the Monroe County border. 3.57 inches of precipitation were measured in Lehighton, 3.19 inches in Jim Thorpe, ,ad 2.28 inches in Albrightsville. The Doppler Storm Radar estimates there were 5 inches of precipitation along the Monroe County border in the Pohopoco Creek drainage basin.
7/26/2015	Christmans. Repeated showers and thunderstorms with very heavy rain caused flash flooding of smaller streams nad roadways in Penn Forest and Kidder Townships. Roadway flooding was reported in Penn Forest Township. Precipitation totals were measured as 3.36 inches in Albrightsville, 3.22 inches in Meckesville, and 2.76 inches in Christmans.
7/7/2017	Germans. Heavy rainfall led to flooding in Carbon and Northampton Counties. SR 895 at Germans Road was closed. Rainfall was measured upwards of 4 to 6 inches in the County.
"Countywide" indicates several locations in the County were affected.	

Table 4.3.2-2 provides further past occurrences of flood events from 1841-1987 from the County's HVA.

TABLE 4.3.2-2 CARBON COUNTY RECORDS OF FLOOD AND FLASH FLOOD EVENTS IMPACTING THE COUNTY FROM 1841-1987 (CCEMA, 2009) (KRAUS, 1989).

DATE	LOCATION AND/OR DESCRIPTION
June 9, 1841	Minor flooding washed away several buildings and the Beaver Meadow Railroad between Weatherly and Parryville. The event claimed the lives on one family.
August 1861	Minor Flooding

DATE	LOCATION AND/OR DESCRIPTION
June 1862	Heavy rain and water volume broke the dam at White Haven which drowned 150 people and damaged the White Haven canal, which was never rebuilt. Half of the structures along Susquehanna Street in White Haven were washed away.
October 1869	Minor Flooding
February 1901	Minor Flooding
August 1901	Flooding along Mauch Chunk Creek caused water to breach the creek banks at Broadway Street, claiming four lives.
February 1902	Minor Flooding
January 1925	Minor Flooding
August 23, 1933	Extensive damage and flooding occurred in Jim Thorpe which resulted in one fatality.
August 1955	Hurricane Diane caused flooding and extensive damage in Weissport Borough. Several other areas incurred damages as a result of this flooding but not as extensive as Weissport Borough. A dike was constructed along the Lehigh River in Weissport as a result of this flood and an Emergency Declaration was issued. Damage was estimated between $750,000 and $1 million in Jim Thorpe Borough.
September 22-23, 1955	Minor flooding occurred
August 1, 1969	A major flood occurred, causing extensive damage in Jim Thorpe. Other areas of the country were impacted including Nesquehoning's Green Acres Industrial Park.
June 1972	Extensive damage and flooding occurred throughout the County and an Emergency Declaration was filed and issued.
September 1985	Hurricane Gloria caused major flooding in several areas of the County and major flooding occurred in Palmerton. A Disaster Assistance Center was opened in Palmerton.
September 1987	Major flooding occurred throughout the County and the County EOC was activated. Damage assessment was conducted in the Palmerton area to determine impact.

The NFIP identifies properties that frequently experience flooding. Floods are the most common and costly natural catastrophe. In terms of economic disruption, property damage, and loss of life, flood as "nature's number-one disaster." For that reason, flood insurance is almost never available under industry-standard homeowner's and renter's policies. The best way for citizens to protect their property against loss to flood is to purchase flood insurance through the NRIP.

Since 1983, the chief means of providing flood insurance coverage has been a cooperative venture of FEMA and the private insurance industry known as the Write Your Own (WYO) Program. This partnership allows qualified property and casualty insurance properties to "write" (that is, issue) and service the NFIP's Standard Flood Insurance Policy under their own names.

Today, nearly 60 WYO insurance companies issue and service the NFIP under their own names (FEMA, 2021b). More than 5 million federal flood insurance policies are in force. These policies represent over 1.3 trillion in flood insurance coverage for homeowners, renters, and business owners throughout the United States and its territories. As of March 2021,

Pennsylvania had a total of 50,457 policies in force across the state, 184 of which were in Carbon County (FEMA CIS, 2021c).

The NFIP provides flood insurance to individuals in communities that are members of the program. Membership in the program is contingent on the community adopting and enforcing floodplain management and development regulations. The NFIP is based on the voluntary participation of communities of all sizes. In the context of this program, a "community" is a political entity – whether an incorporated city, town, township, borough, or village, or an unincorporated area of a county or parish – that has legal authority to adopt and enforce floodplain management ordinances for the area under its jurisdiction.

National Flood Insurance is available only in communities that apply for participation in the NFIP and agree to implement prescribed flood mitigation measures. Newly participating communities are admitted to the NFIP's Emergency Program. Most of these communities quickly earn "promotion" to the Regular Program.

The Emergency Program is the initial phase of a community's participation in the NFIP. In return for the local government's agreeing to adopt basic floodplain management standards, the NFIP allows local property owners to buy modest amounts of flood insurance coverage. In return for agreeing to adopt more comprehensive floodplain management measures, an Emergency Program community can be "promoted" to the Regular Program. Local policyholders immediately become eligible to buy greater amounts of flood insurance coverage. All participating municipalities in Carbon County are in the Regular Program.

The minimum floodplain management requirements include:

- Review and permit all development in the SFHA;
- Elevate new and substantially improved residential structures at or above the Base Flood Elevation;
- Elevate or dry floodproof new and substantially improved non-residential structures;
- Limit development in floodways;
- Locate or construct all public utilities and facilities so as to minimize or eliminate flood damage; and
- Anchor foundation or structure to resist floatation, collapse, or lateral movement.

Table 4.3.2-3 below lists municipal participation in the NFIP. Note that all municipalities in the County participate in the program.

TABLE 4.3.2-3 CARBON COUNTY MUNICIPAL PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM (FEMA CIS, 2021A)

MUNICIPALITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Banks Township	Participating	421452	10/1/1986	6/3/2002
Beaver Meadows Borough	Participating	420247	6/3/2002	6/3/2002
Bowmanstown Borough	Participating	420248	9/3/1982	6/3/2002
East Penn Township	Participating	421013	6/15/1977	6/3/2002
East Side Borough	Participating	422360	9/1/1986	6/3/2002
Franklin Township	Participating	421014	8/1/1977	6/3/2002
Jim Thorpe Borough	Participating	420249	8/15/1977	6/3/2002

MUNICIPALITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Kidder Township	Participating	421453	2/2/1989	6/3/2002
Lansford Borough	Participating	420250	5/21/1982	6/3/2002
Lausanne Township	Participating	421454	3/18/1983	6/3/2002
Lehigh Township*	Participating	421224	1/14/1983	6/3/2002
Lehighton Borough	Participating	420251	9/15/1977	6/3/2002
Lower Towamensing Township	Participating	421455	11/15/1989	6/3/2002
Mahoning Township	Participating	421041	9/29/1978	6/3/2002
Nesquehoning Borough	Participating	420252	7/3/1990	6/3/2002
Packer Township	Participating	421456	9/1/1986	6/3/2002
Palmerton Borough	Participating	420253	9/15/1978	6/3/2002
Parryville Borough	Participating	420254	3/1/1978	6/3/2002
Penn Forest Township	Participating	421457	2/2/1989	6/3/2002
Summit Hill Borough	Participating	421451	12/14/1979	6/3/2002
Towamensing Township	Participating	421458	11/1/1986	6/3/2002
Weatherly Borough	Participating	420255	12/5/1989	6/3/2002
Weissport Borough	Participating	420256	2/2/1990	6/3/2002
*Erroneously listed as Thornhurst Township in FEMA's CIS				

In addition, Regular Program communities are eligible to participate in the NFIP's Community Rating System (CRS). Under the CRS, policyholders can receive premium discounts of 5 to 45 percent as their cities and towns adopt more comprehensive flood mitigation measures. Currently, no municipalities in Carbon County participate in CRS.

Information on NFIP premiums and coverage, prior claims, and substantial damage claims provide additional information on past flood occurrences. Table 4.3.2-4 lists this information for each municipality in Carbon County.

TABLE 4.3.2-4 CARBON COUNTY NFIP POLICIES AND CLAIMS INFORMATION (FEMA CIS, 2021B) (FEMA CIS, 2021C)

MUNICIPALITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Banks Township	0	$0	0	$0	0
Beaver Meadows Borough	0	$0	0	$0	0
Bowmanstown Borough	7	$709,961	1	$8,355	0
East Penn Township	5	$524,989	6	$27,213	0
East Side Borough	0	$0	0	$0	0
Franklin Township	12	$1,884,769	3	$7,334	0
Jim Thorpe Borough	7	$869,282	0	$ 0	0

MUNICIPALITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Kidder Township	7	$1,598,453	4	$11,203	0
Lansford Borough	1	$52,000	0	$ 0	0
Lausanne Township	0	$0	0	$0	0
Lehigh Township*	1	$333,159	0	$ 0	0
Lehighton Borough	2	$378,645	2	$3,672	0
Lower Towamensing Township	19	$4,116,657	10	$21,227	0
Mahoning Township	12	$3,522,441	3	$29,110	0
Nesquehoning Borough	15	$4,254,162	6	$29,229	0
Packer Township	2	$133,718	2	$27,094	0
Palmerton Borough	40	$6,676,942	42	$213,225	0
Parryville Borough	2	$158,721	2	$ 0	1
Penn Forest Township	17	$4,829,721	5	$21,134	0
Summit Hill Borough	0	$0	0	$0	0
Towamensing Township	3	$298,772	0	$ 0	0
Weatherly Borough	2	$843,973	2	$ 0	0
Weissport Borough	33	$3,673,688	6	$7,761	0
Total	187	$3,4860,053	94	$406,557	1
*Erroneously listed as Thornhurst Township in FEMA's CIS					

In addition to past flood events, the NFIP identified properties that experience frequent flooding and can be used to determine areas of higher risk. These properties are identified through the NFIP when they receive more than one payment for flood damages. The NFIP defines a Repetitive Loss (RL) property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978." The RL data provided in Table 4.3.2-4 and throughout this Plan Update represents the NFIP's definition of RL

With respect to obtaining mitigation funding, FEMA's Hazard Mitigation Assistance (HMA) grant program defines a RL property as a structure that:

- Is covered by a contract for flood insurance made available under the NFIP; and
- Has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and
- At the time of the second incident of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage (ICC). (Note: Homes are eligible for ICC coverage after the first loss, however the cost for ICC is part of all policies.)
- The NFIP defines Repetitive Loss as 2 or more claims of at least $1,000 over a 10 year rolling period.

Under FEMA's HMA grant programs, a Severe Repetitive Loss property is a structure that:

- Is covered under a contract for flood insurance made available under the NFIP; and
- Has incurred flood related damage (i) For which four or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or (ii) For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

As of March 26, 2021, there are 13 repetitive loss properties in Carbon County, one of which was insured (FEMA CIS, 2021d). These repetitive loss properties are located in East Penn Township, Lehighton Borough, Lower Towamensing Township, Nesquehoning Borough, and Palmerton Borough. In 2015, there were only three repetitive loss properties, indicating increased flooding in certain areas of Carbon County. Table 4.3.2-5 shows the number of repetitive loss properties by municipality. There are no severe repetitive loss properties in Carbon County.

TABLE 4.3.2-5 REPETITIVE LOSS PROPERTIES IN CARBON COUNTY BY MUNICIPALITY (PEMA, 2021).

MUNICIPALITY	REPETITIVE LOSS PROPERTIES	SEVERE REPETITIVE LOSS PROPERTIES	TYPE OF STRUCTURE	NUMBER OF LOSSES
Banks Township	0	0		0
Beaver Meadows Borough	0	0		0
Bowmanstown Borough	0	0		0
East Penn Township	1	0	Residential	3
East Side Borough	0	0		0
Franklin Township	0	0		0
Jim Thorpe Borough	0	0		0
Kidder Township	0	0		0
Lansford Borough	0	0		0
Lausanne Township	0	0		0
Lehigh Township*	0	0		0
Lehighton Borough	1	0	Residential	1
Lower Towamensing Township	1	0	Residential	2
Mahoning Township	0	0		0
Nesquehoning Borough	1	0	Residential	1
Packer Township	0	0		0
Palmerton Borough	5	0	Residential	10
Parryville Borough	0	0		0
Penn Forest Township	0	0		0
Summit Hill Borough	0	0		0
Towamensing Township	0	0		0
Weatherly Borough	0	0		0
Weissport Borough	0	0		0
TOTAL	8	0		16

4.3.2.4. Future Occurrence

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. The NFIP uses historical records to determine the probability of occurrence for different extents of flooding. In this plan, the term "Special Flood Hazard Area" is used rather than floodplain to clarify that the area under considerations is identified on the FIRM as having at least a 1-percent chance of flooding in any given year. Historically, the area with a 1-percent chance of flooding in any given year has been called the "100-year floodplain" or the "base flood" and the area with a 0.2-percent chance of flooding in any given year has been called the "500-year floodplain." As these terms can be misleading by suggesting that there will be a flood only every 100 or 500 years respectively, they are not used in this plan. The 1- and 0.2- percent-annual-chance-floods are delineated on the Carbon County FIRM. Areas subject to 2 percent- and 10 percent-annual-chance-flood events are not shown on FIRMs; however, water surface elevations associated with these events are included in the flood source profiles contained in the FIS report. The most recent FIS for each county in Pennsylvania is available from the FEMA Map Service Center (https://msc.fema.gov/). Table 4.3.2-6 shows a range of flood recurrence intervals and associated probabilities of occurrence.

TABLE 4.3.2-6 RECURRENCE INTERVALS AND ASSOCIATED PROBABILITIES OF OCCURRENCE.

RECURRENCE INTERVALS	CHANCE OF OCCURRENCE IN ANY GIVEN YEAR (%)
10 year	10
50 year	2
100 year	1
500 year	0.2

In Carbon County, flooding occurs commonly and can occur during any season of the year. However, the possibility of flooding is greatly reduced during the winter months. Although most severe floods are attributable to rainfall alone, the spring floods can be compounded by snowmelt and moving ice. The major floods in the late summer and fall are often associated with tropical storms moving up the Atlantic coastline. Within the flood-susceptible areas in Carbon County, it is expected that the character of flooding will remain essentially unchanged from what has been experienced for many years. However, some increases in the severity and frequency of flooding may result due to planned or recent development within the floodplains of various streams, as well as increased intensity and frequency of rain event. Therefore, the future occurrence of flooding for Carbon County can be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.2.5. Vulnerability Assessment

Carbon County is vulnerable to flooding that causes loss of lives, property damage, and road closures. For purposes of assessing vulnerability, the County focused on community assets that are located in the 1-percent-annual-chance floodplain. While greater and smaller floods are possible, information about the extent and depths for this floodplain is available for all municipalities countywide, thus providing a consistent basis for analysis. Flood vulnerability maps for each applicable local municipality, showing the 1-percent-annual-chance flood

hazard area, critical facilities impacted, and transportation routes are included in Appendix D. These maps were created using FEMA FIRM data from the current effective FIRMs.

Table 4.3.2-7 lists the total structures, critical facilities, and populations intersecting the SFHA along with the total number of addressable structures, critical facilities, and population in each municipality.

About three percent of the structures in Carbon County are in the SFHA; three municipalities have over nine percent of their structures in the SFHA: Bowmanstown Borough, Palmerton Borough, and Weissport Borough. Weissport Borough has the highest percentage, with almost 100 percent of structures – and 100 percent of critical facilities and population – in the SFHA. Four municipalities have zero structures in the SFHA: Beaver Meadows Borough, East Side Borough, Lausanne Township, and Summit Hill Borough. These municipalities do not have population in the SFHA. Banks Township, Lansford Borough, and Lehigh Township each have less than ten structures in the SFHA. Palmerton Borough and Towamensing Township have the most critical facilities in the SFHA with six and seven respectively. The entire population of Weissport Borough is located in the SFHA. For more information on the flood vulnerability of each individual critical facility, please see Appendix E.

Table 4.3.2-8 lists the number of structures in the SFHA by land use type in each municipality. Residential structures represent about 78% of structures in the SFHA. The next highest land use category is commercial uses; only twenty commercial structures are in the SFHA throughout the County. Mobile homes are particularly vulnerable to flood risk; luckily, no mobile homes in the County are located in the SFHA.

TABLE 4.3.2-7 COMMUNITY FLOOD VULNERABILITY IN CARBON COUNTY

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILIITES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
Banks Township	655	1	0.2%	8	1	12.5%	1685	2	0.1%
Beaver Meadows Borough	441	0	0%	2	0	0%	869	0	0%
Bowmanstown Borough	428	34	7.9%	4	0	0%	937	65	6.9%
East Penn Township	1,552	148	9.5%	10	1	10.0%	3135	67	2.1%
East Side Borough	322	0	0%	1	0	0%	319	0	0%
Franklin Township	2,207	43	1.9%	13	3	23.1%	4275	83	1.9%
Jim Thorpe Borough	2,473	50	2.0%	25	2	8.0%	4781	92	1.9%
Kidder Township	3,736	32	0.9%	36	0	0%	2269	22	1.0%
Lansford Borough	2,096	6	0.3%	5	0	0%	3941	10	0.3%
Lausanne Township	132	0	0%	3	0	0%	248	0	0%
Lehigh Township	289	8	2.8%	7	0	0%	528	7	1.3%
Lehighton Borough	2,383	20	0.8%	12	0	0%	5498	27	0.5%
Lower Towamensing Township	1,540	74	4.8%	8	1	12.5%	3363	137	4.1%
Mahoning Township	1,989	46	2.3%	11	0	0%	4361	70	1.6%
Nesquehoning Borough	1,646	24	1.5%	17	1	5.9%	3431	46	1.3%
Packer Township	512	18	3.5%	5	1	20.0%	1230	32	2.6%
Palmerton Borough	2,328	212	9.1%	13	6	46.2%	5468	559	10.2%
Parryville Borough	311	13	4.2%	4	0	0%	512	16	3.1%
Penn Forest Township	7,200	32	0.4%	21	1	4.8%	9915	34	0.3%
Summit Hill Borough	1,496	0	0%	8	0	0%	3075	0	0%
Towamensing Township	1,980	36	1.8%	20	7	35.0%	5056	83	1.6%
Weatherly Borough	1,009	17	1.7%	7	2	28.6%	2525	25	1.0%
Weissport Borough	173	172	99.4%	3	3	100%	412	412	100%
TOTAL	**36,898**	**986**	**2.7%**	**243**	**29**	**11.9%**	**67833**	**1,789**	**2.6%**

TABLE 4.3.2-8 FLOOD VULNERABILITY BY LAND USE

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN SFHA						
		CIVIC	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	UNKNOWN	UTILITY	TOTAL STRUCTURES IN SFHA
Banks Township	655	0	1	0	0	0	0	1
Beaver Meadows Borough	441	0	0	0	0	0	0	0
Bowmanstown Borough	428	1	6	0	24	2	1	34
East Penn Township	1,552	9	3	0	134	2	0	148
East Side Borough	322	0	0	0	0	0	0	0
Franklin Township	2,207	4	1	0	36	2	0	43
Jim Thorpe Borough	2,473	4	3	0	42	1	0	50
Kidder Township	3,736	0	1	0	24	7	0	32
Lansford Borough	2,096	0	0	0	6	0	0	6
Lausanne Township	132	0	0	0	0	0	0	0
Lehigh Township	289	6	0	0	2	0	0	8
Lehighton Borough	2,383	2	6	0	11	0	1	20
Lower Towamensing Township	1,540	0	6	2	62	3	1	74
Mahoning Township	1,989	4	10	0	30	2	0	46
Nesquehoning Borough	1,646	1	8	1	14	0	0	24
Packer Township	512	1	0	1	15	1	0	18
Palmerton Borough	2,328	7	54	0	146	4	1	212
Parryville Borough	311	1	0	0	8	4	0	13
Penn Forest Township	7,200	0	0	0	28	4	0	32
Summit Hill Borough	1,496	0	0	0	0	0	0	0
Towamensing Township	1,980	2	0	0	34	0	0	36
Weatherly Borough	1,009	1	7	0	9	0	0	17
Weissport Borough	173	3	20	0	142	7	0	172
Grand Total	**36,898**	**46**	**126**	**4**	**767**	**39**	**4**	**986**

It is important to note that according to the CCEMA, flood control projects in Weissport along the Lehigh River and in the Mauch Chunk Creek Watershed have served to greatly reduce damages and the threat to life and property loss (CCEMA, 2009). For example, when possible, both the Francis E. Walter and Beltzville dams will be operated to provide flood damage reduction benefits during ice jam events (USACE, 2015a).

Additional information on flood vulnerability and losses in Carbon County, including the 1 percent annual chance flood event results from HAZUS, is provided in Section 4.4.3, Potential Loss Estimates.

4.3.3. Hailstorm

4.3.3.1. Location and Extent

Hailstorms are not limited to any particular geographic area of Carbon County, outside of three notable storm trajectories illustrated in Figure 4.3.3-1, and neither the duration of the storm nor the extent of area affected by such an occurrence can be predicted. Hail precipitation is often produced at the front of a severe thunderstorm system or in conjunction with a tornado event. Hailstorms occur when ice crystals form within a low-pressure front due to the rapid rise of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation in the form of balls or irregularly shaped masses of ice. Hailstones are formed most commonly in thunderstorms with intense updraft, high liquid water content, large vertical extent, large water droplets, and cloud layers below freezing (NOAA NSSL, 2021).

4.3.3.2. Range of Magnitude

Hail is described qualitatively and quantitatively by its size and can range from 0.2 inches to 4.5 inches; as shown in Table 4.3.3-1. The size of hail is dependent on the strength of the upward air movement along the front of a thunderstorm, called the updraft. Hailstone nuclei are buoyed or lifted by the updraft and increase in size the longer the stone is held aloft. Weaker updrafts create smaller hailstones while strong updrafts provide a longer amount of time for hailstone nuclei to grow in diameter (NOAA NSSL, 2021). Carbon County has experienced hail ranging in size from 0.75 to 3.00 inches in diameter (NOAA NCEI, 2021).

TABLE 4.3.3-1 HAILSTONE SIZE AND RELATIONSHIP TO UPDRAFT SPEED (NOAA NSSL, 2021)

HAILSTONE SIZE	MEASUREMENT (IN)	UPDRAFT SPEED (MPH)
BB	< 0.25	< 24
Pea	0.25	24
Marble	0.5	35
Dime	0.7	38
Penny	0.75	40
Nickel	0.88	46
Quarter	1	49

HAILSTONE SIZE	MEASUREMENT (IN)	UPDRAFT SPEED (MPH)
Half Dollar	1.25	54
Walnut	1.5	60
Golf Ball	1.75	64
Hen Egg	2	69
Tennis Ball	2.5	77
Baseball	2.75	81
Teacup	3	84
Grapefruit	4	98
Softball	4.5	103

Hailstorms can cause significant damage to crops, livestock, and property, depending on the size, duration, and intensity of hail precipitation. Automobiles and aircraft are particularly susceptible to damage. Also, those who do not seek shelter could face serious injury. Since hail precipitation usually occurs during thunderstorm events, the impacts of other hazards associated with thunderstorms (i.e. strong winds, intense precipitation, etc.) often occur simultaneously (NOAA NSSL, 2021).

Storms carrying hail of over two inches occurring over a prolonged period in Carbon County can cause massive damage. Because hail can cause significant damage to crops and structures, a storm of this magnitude would potentially cause property damage, injures, and potentially destroy agricultural yields and result in significant lost revenue. A worst-case scenario occurred in August 2007, when a hailstorm that affected multiple counties caused $1 million of damage moving from Weatherly Borough into Palmerton Borough with tennis ball and baseball sized hail. Another significant event occurred in Lansford Borough in 2011 causing around $50,000 in property loss damage.

4.3.3.3. Past Occurrence

The NCDC reports 41 hail events in Carbon County from 1966-2020 causing over $1 million in property damage. As is typical, most of these events occurred from April to August, and most events occurred in the afternoon/early evening.

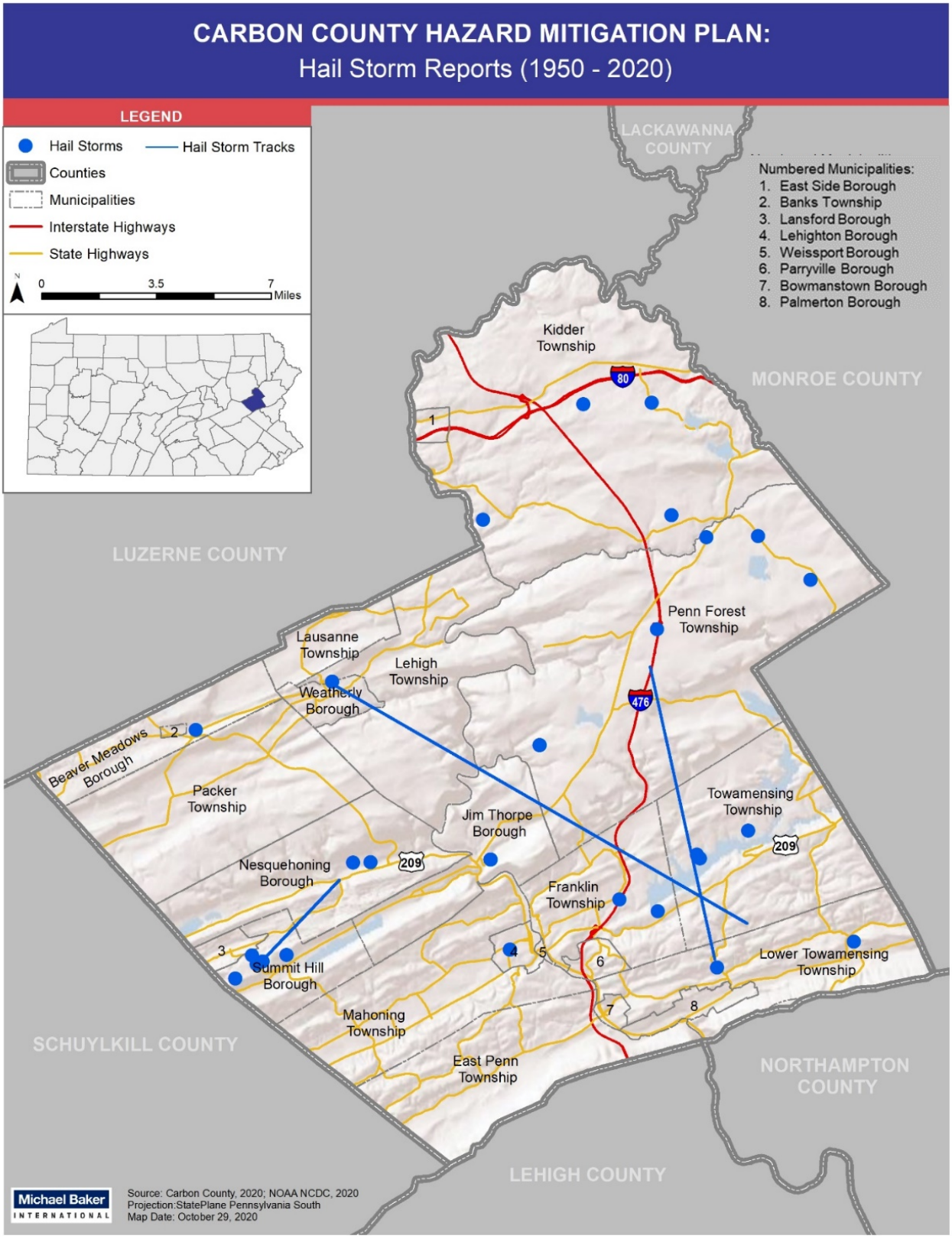
TABLE 4.3.3-2 CARBON COUNTY HAIL EVENTS (NOAA NCEI, 2021).

LOCATION	DATE	SIZE (IN)	INJURIES/ FATALITIES	PROPERTY LOSSES	CROP LOSSES
Countywide	7/28/1966	1	0	$0.00	$0.00
Countywide	8/31/1973	0.75	0	$0.00	$0.00
Countywide	7/3/1975	0.75	0	$0.00	$0.00
Countywide	6/30/1976	1.75	0	$0.00	$0.00
Countywide	6/30/1976	1.75	0	$0.00	$0.00
Countywide	5/31/1985	1.75	0	$0.00	$0.00
Countywide	6/16/1985	1	0	$0.00	$0.00
Countywide	6/24/1985	2	0	$0.00	$0.00
Countywide	6/24/1985	1.75	0	$0.00	$0.00
Countywide	7/26/1987	1.5	0	$0.00	$0.00

LOCATION	DATE	SIZE (IN)	INJURIES/ FATALITIES	PROPERTY LOSSES	CROP LOSSES
Countywide	7/9/1990	0.75	0	$0.00	$0.00
Lansford	6/12/1994	0.75	0	$0.00	$0.00
Christmans	6/21/1995	0.75	0	$0.00	$0.00
Lehighton	6/4/1996	0.75	0	$0.00	$0.00
Jim Thorpe	5/6/1997	0.75	0	$0.00	$0.00
Weatherly	9/7/1998	0.75	0	$0.00	$0.00
Jim Thorpe	5/10/2000	0.75	0	$0.00	$0.00
Lake Harmony	5/27/2001	1.5	0	$0.00	$0.00
Albrightsville	7/11/2001	0.75	0	$0.00	$0.00
Beaver Meadows	5/30/2006	1	0	$0.00	$0.00
Nesquehoning	7/9/2006	1.5	0	$0.00	$0.00
Weatherly	8/17/2007	2.5	0	$750,000	$0.00
Palmerton	8/17/2007	2.75	0	$250,000	$0.00
Lehighton	8/25/2007	0.75	0	$0.00	$0.00
Meckesville	7/27/2008	0.75	0	$0.00	$0.00
Stemlersville	8/10/2008	0.88	0	$0.00	$0.00
Lake Harmony	8/10/2008	0.75	0	$0.00	$0.00
Lansford	3/29/2009	1.5	0	$0.00	$0.00
Jim Thorpe	3/29/2009	0.88	0	$0.00	$0.00
Stemlersville	6/15/2009	0.88	0	$0.00	$0.00
Jim Thorpe	7/29/2009	1	0	$0.00	$0.00
Lansford	5/26/2011	3	0	$50,000	$0.00
Lansford	7/7/2011	0.75	0	$0.00	$0.00
Lehighton	7/28/2012	0.75	0	$0.00	$0.00
Christmans	5/22/2014	1	0	$0.00	$0.00
Stemlersville	5/22/2014	0.75	0	$0.00	$0.00
Lehighton	7/3/2014	1.25	0	$0.00	$0.00
Harrity	7/3/2014	1	0	$0.00	$0.00
Albrightsville	8/13/2016	0.75	0	$0.00	$0.00
Meckesville	5/29/2019	1.25	0	$0.00	$0.00
Nesquehoning	7/6/2020	1.25	0	$0.00	$0.00

Figure 4.3.3-1 maps the recorded hailstorm events in Carbon County between 1950 and 2020. Hail events have occurred throughout the County. Three events were distributed primarily along specific trajectories through the county.

FIGURE 4.3.3-1 REPORTED HAILSTORM EVENTS BETWEEN 1950 AND 2020



4.3.3.4. Future Occurrence

It is not possible to predict the formation of a hailstorm with more than a few days' lead time. The past occurrences in the County described above, however, indicate that this event is one that can happen several times in any given year, most likely during the late spring and summer months. Based on prior occurrences, the County can expect 75% probability of hailstorms occurring annually. Therefore, the future occurrence of hailstorms in Carbon County can be considered *possible* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.3.5. Vulnerability Assessment

All of Carbon County, including all critical infrastructure, is vulnerable to the effects of hail, as the storm cells that produce this hazard are spread over a large (multi-county) area. The area of damage due to these storms is relatively small, in that a single storm does not cause widespread devastation, but may cause damage in a focused area of the storm.

As a hazard, damage to crops and vehicles are typically the most significant impacts of hailstorms. Damage to trees, shrubbery, and other vegetation may occur during hailstorm events through defoliation. Unless there are compounding stresses, natural vegetation can typically recover over time following the event. However, crops such as corn and soybeans can be damaged to the point of total loss, particularly if an event occurs later in the growing season.

Potential losses from a hailstorm event can be derived from agricultural sales information as reported in the Drought hazard profile, Section 4.3.1. There are 200 farms located in Carbon County. These businesses sold approximately $13,029,000 in agricultural products in 2017, the majority of which came from crop sales (88%) (USDA, 2017). Corn and soybean crops are particularly vulnerable, and in 2017, corn for grain and soybeans were two of the top crop items by acres in Carbon County (USDA, 2017).

4.3.4. Hurricane, Tropical Storm, Nor'easter

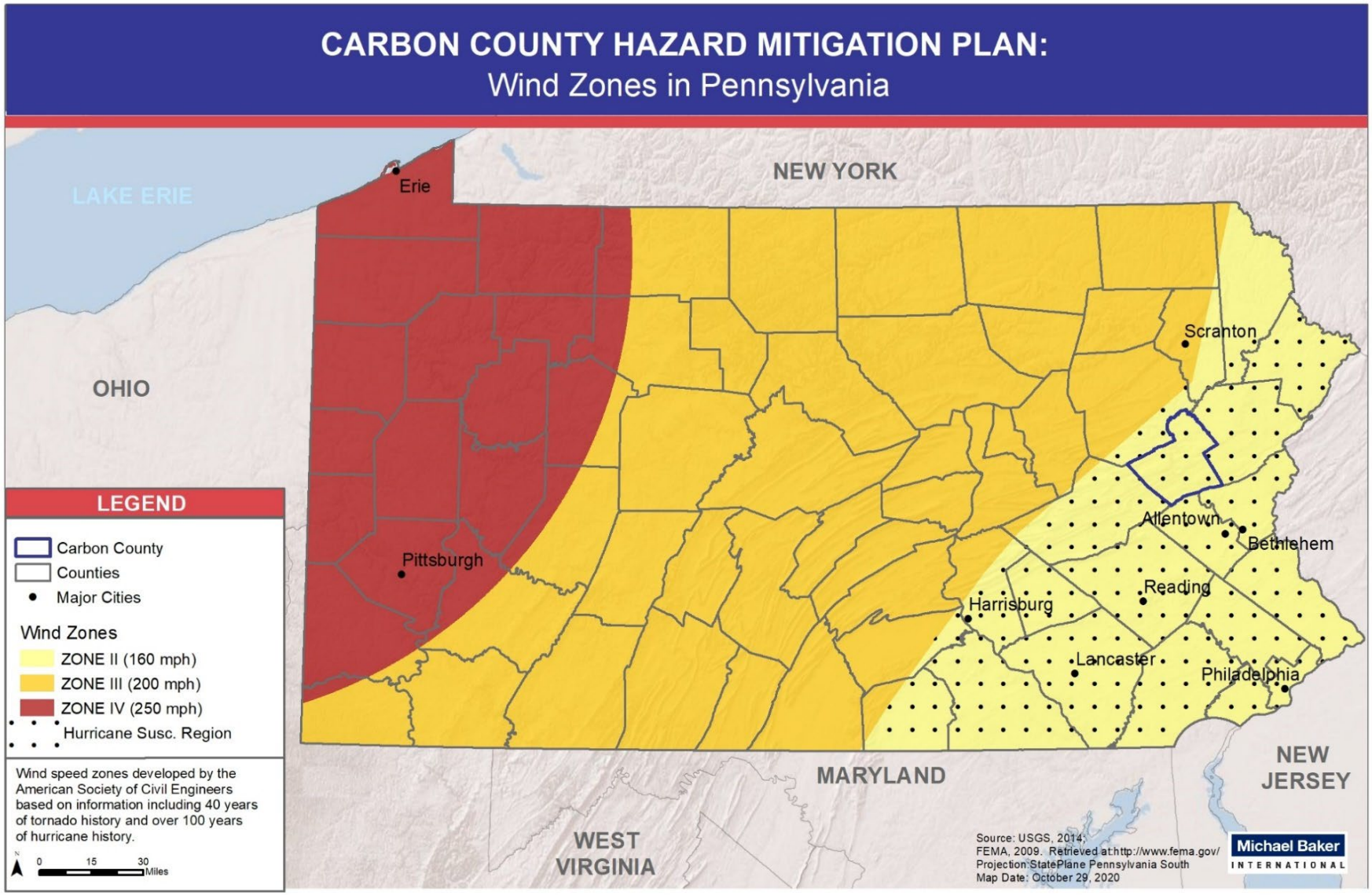
4.3.4.1. Location and Extent

Tropical storms impacting Carbon County develop in tropical or sub-tropical waters found in the Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. Cyclones with maximum sustained winds of less than 39 miles per hour (mph) are called tropical depressions. A tropical storm is a cyclone with maximum sustained winds between 39-74 mph. These storms sometimes develop into hurricanes with wind speeds in excess of 74 mph. While Carbon County is located about 80 miles from the Atlantic Coast, hurricanes and tropical storms can track inland causing heavy rainfall and winds. Nor'easters typically develop as extra-tropical storms which can produce winds equivalent to hurricane or tropical storm force as well as heavy precipitation, sometimes in the form of snow. These storms are regional events that can impact very large areas hundreds to thousands of miles across over the life of the storm. Therefore, all communities within Carbon County are equally subject to the impacts of hurricanes, tropical storms, and Nor'easters. Areas in Carbon County which are subject to flooding, wind, and winter storm damage are particularly vulnerable.

Figure 4.3.4-1 shows wind speed zones developed by the American Society of Civil Engineers in 2012 based on information including 40 years of tornado history and over 100 years of hurricane history. The most current data available includes data collected by USGS through 2014. It identifies wind speeds that could occur across the United States to be used as the

basis for design and evaluation of the structural integrity of shelters and critical facilities. Carbon County falls within Zone II, meaning design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 160 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. Carbon County also falls wholly within the identified Hurricane Susceptibility Region.

FIGURE 4.3.4-1 DESIGN WIND SPEEDS FOR COMMUNITY SHELTERS ACROSS PENNSYLVANIA



4.3.4.2. Range of Magnitude

The impacts associated with hurricanes, tropical storms, and Nor'easters are primarily wind damage and flooding. It is not uncommon for tornadoes to develop during these events. Historical tropical storm, hurricane, and Nor'easter events have brought intense rainfall, sometimes leading to damaging floods, northeast winds, which, combined with waterlogged soils, caused trees and utility poles to fall.

The impact that tropical storms, hurricanes, and Nor'easters have on an area are typically measured in terms of wind speed. Expected damage from hurricane force winds is measured using the Saffir-Simpson Scale. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential (characteristic of tropical storms and hurricanes, but not a threat to Carbon County), which are combined to estimate potential damage. Table 4.3.4-1 lists Saffir-Simpson Scale categories with associate wind speeds and expected damages. Categories 3, 4, and 5 are classified as "major" hurricanes. While major hurricanes comprise only 20 percent of all tropical cyclones making landfall, they account for over 70 percent of the damage in the United States.

TABLE 4.3.4-1 SAFFIR-SIMPSON SCALE CATEGORIES WITH ASSOCIATED WIND SPEEDS AND DAMAGES (NHC, 2009).

STORM CATEGORY	WIND SPEED (MPH)	DESCRIPTION OF DAMAGES
1	74-95	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-130	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	131-155	Extreme damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	>155	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

The likelihood of these damages occurring in Carbon County is assessed in Section 4.3.4.4. Wind impacts in Carbon County generally include downed trees and utility poles, which can spark widespread utility interruptions. Wind events can be particularly damaging to mobile homes and other manufactured housing; these structures are often not well-anchored and are highly susceptible to wind damage in a hurricane, tropical storm, or Nor'easter.

It is also important to recognize the potential for flooding during hurricane, tropical storm, and Nor'easter events; the risk assessment for these events is included in Section 4.3.2. Environmental impacts associated with hurricanes and tropical storms are consistent with the impacts described for flooding in Section 4.3.2.2. The impact of severe winter weather which sometimes occurs during Nor'easter events is discussed in Section 4.3.9.

According to the NOAA NCEI, the largest magnitude winds recorded in Carbon County occurred on Lake Harmony in Kidder Township in May 2001 and measured 69 knots with wind gusts estimated to be between 75 and 80 mph. This measurement falls within Storm Category 1 with expected damages being minimal and having no significant structural damage. This event was not associated with a tropical storm, but it serves as an example of the upper range of magnitude that can be expected to occur in the County. During this incident, nineteen people were injured when a tent collapsed at a local festival, and dozens of trees were uprooted as well, damaging at least two vehicles, one of which was occupied; no deaths occurred (NOAA NCEI, 2021).

The worst-case event for a tropical storm in Carbon County was Tropical Storm Lee/Hurricane Irene in 2011. Hurricane Irene made landfall in the US on August 27, 2011 and again on August 28, dumping between two and eight inches of rain in eastern Pennsylvania, with its worst rain occurring in the Delaware River basin. One and a half weeks later, beginning on September 5, Tropical Storm Lee and its associated heavy rainfall moved through Pennsylvania and New York. With large portions of the Susquehanna River Basin already saturated by Hurricane Irene, Lee's rain caused flash flooding and riverine flooding in and east of the Susquehanna River Valley. The heavy rain broke previous precipitation records set by the former worst-case, Tropical Storm Agnes, and caused multiple new floods of record throughout the state. Lee caused flash flooding and flooding in Beaver Meadows and Albrightsville in Carbon County (NOAA NCEI, 2021).

Another notable event in Carbon County was when Hurricane Sandy went through eastern Pennsylvania on October 29, 2012. Carbon did not experience the same extent of flooding as it did in 2011; however, the storm did cause wind gusts of up to 56 knots resulting in utility outages across the area. One man died in Carbon County due to carbon monoxide poisoning from running a generator after the power outage, and a firefighter was injured responding to the call for the man (NOAA NCEI, 2021).

The largest nor'easter to impact Carbon County in recent years occurred in 2016. The storm produced record snowfall in eastern Pennsylvania, with 18 inches of snow recorded near Palmerton. Wind gusts over 35 MPH led to blizzard conditions and reduced visibility to less than a quarter mile in some places (NOAA NCEI, 2021).

4.3.4.3. Past Occurrence

Figure 4.3.4-2 illustrates the historical coastal storms that have tracked through Pennsylvania. It is important to note that a number of hurricane, tropical storm, and Nor'easter events have impacted the County without tracking through or near it. Previous tropical storm and hurricane events that have impacted Carbon County are listed in Table 4.3.4-2 with descriptions where

available. With the exception of Tropical Depression Ernesto, Hurricane Gloria, and the Nor'easter events, Presidential Disaster Declarations were issued for all of these events.

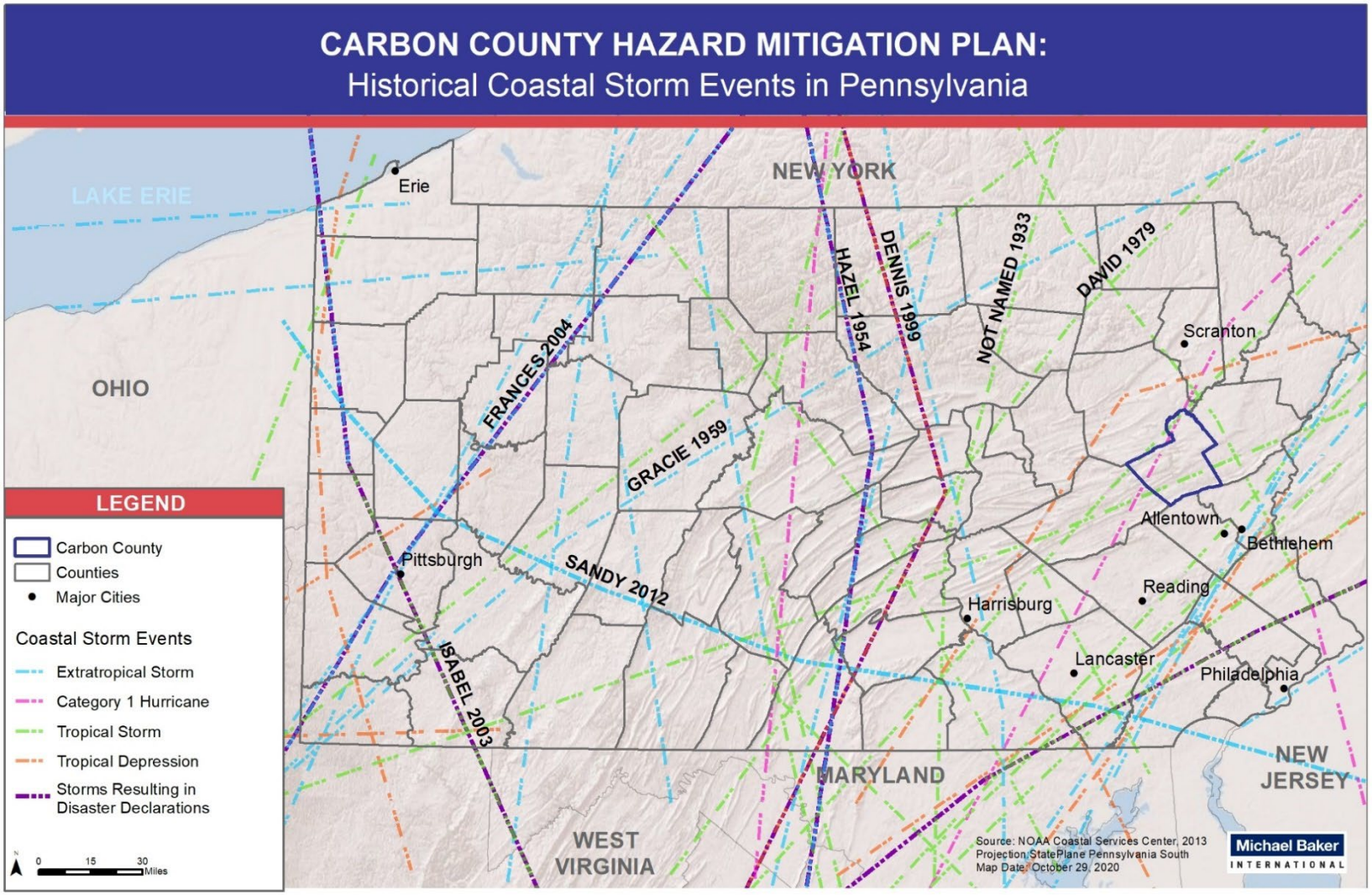
TABLE 4.3.4-2 PREVIOUS HURRICANE, TROPICAL STORM, AND NOR'EASTER EVENTS AFFECTING CARBON COUNTY (NOAA NCEI, 2021).

YEAR	EVENT	DESCRIPTION
2018	Winter Storm*	Precipitation began as wet, heavy snow during the evening hours of March 20th, moving to a drier, heavy snow during the afternoon hours of March 21st. Conditions included freezing rain, sleet, and snow, which resulted in downed tree limbs and power lines across portions of Southeastern Pennsylvania. Snowfall ranged throughout the county; reports included 9.8 inches 3 miles west-southwest of Lehighton, 8.8 inches in Lehighton, 8.5 inches near Danielsville, 7 inches in Lower Towamensing, and 4 inches in Albrightsville.
2017	Winter Weather*	Weather conditions were cold enough for a wintry mix of sleet, snow, and freezing rain in the Southern Poconos. Strong winds exceeded 50 MPH, resulting in some damage. The highest total ice amount associated with the nor'easter occurred in Albrightsville, with 0.25 inches.
2016	Winter Storm*	A Nor'easter produced record snowfall in eastern Pennsylvania from late January 22nd to early January 24th. Wind gusts over 35 MPH produced blizzard conditions and visibility dropped to one-quarter mile or less in spots. 18 inches of snow were reported near Palmerton.
2014	Winter Weather*	Snow wrapping around the Nor'easter dropped 1 to 4 inches of snow across the Poconos mainly during the morning of December 10th, with 1.3 inches recorded in Lehighton, 1.8 inches recorded in Jim Thorpe Borough, and 3.2 inches recorded in Albrightsville.
2013	Winter Weather*	A Nor'easter that moved east of the state on March 25th dropped 1 to 3 inches of snow across Eastern Pennsylvania, with 2.5 inches recorded in Summit Hill.
2012	Hurricane Sandy	As post-Tropical Storm Sandy tracked across Carbon County it caused massive wind gusts resulting in severe power outages. Power outages forced Carbon County 911 operations to default to back-up and emergency powers. A 66-year-old male died at a hospital due to carbon monoxide poisoning from a generator running in his garage; and a firefighter was injured responding to the incident. Five roadways were closed due to the effects of the storm.
2011	Tropical Storm Lee	The remnants of Tropical Storm Lee that interacted with a stalled frontal boundary produced several days with periods of heavy rain across Eastern Pennsylvania.
2011	Hurricane Irene	Tropical Storm Irene produced heavy flooding rain, tropical storm force wind gusts with hundreds of thousands of outages, moderate tidal flooding along the Delaware River.

YEAR	EVENT	DESCRIPTION
2009	Winter Weather*	A major winter storm affected central and southeast Pennsylvania on December 19th and 20th. A lighter accumulating snow affected the Poconos. The Nor'easter responsible for the winter storm formed in the western Gulf of Mexico.
2009	Winter Weather*	A Nor'easter brought an early season measurable snow to the Poconos from the morning of October 15th into the morning of the 16th. Accumulations ranged from less than three inches in the valleys to around six inches over higher terrain. The weight of the snow plus leaves on trees caused scattered power outages in the higher terrain.
2009	Winter Weather*	Snow fell across Eastern Pennsylvania from the evening of the March 1st into the evening of the 2nd. Snowfall averaged four to eight inches across the region. The heaviest snow associated with the Nor'easter occurred farther to the east. In the Poconos, two tractor-trailers collided on Interstate 80 westbound in Carbon County.
2007	Strong Wind*	In the wake of the departing Nor'easter, the combination of strong winds, snow on tree limbs and heavy rain loosening the ground caused many tree limbs, trees and wires to be knocked down on the 16th. Over 160,000 homes and businesses across Eastern Pennsylvania lost power. Carbon and Monroe Counties were among the hardest hit counties. In Carbon County, the downed trees caused most of the east side of Jim Thorpe to lose power for most of the daylight hours on April 16th. The docket for the county courthouse was cancelled for the day. In Mahoning Township, part of the metal flashing on the roof of the Times News newspaper was torn away.
2007	Heavy Snow*	A Nor'easter caused heavy sleet to fall across the greater Philadelphia Metropolitan Area, heavy snow and sleet to fall across Berks County and the Lehigh Valley and heavy snow in the Poconos on March 16th into the early morning of the 17th. The winter storm caused scores of accidents. Snow and sleet totals included 18 inches in Albrightsville (Kidder Township and Penn Forest Township).
2006	Tropical Depression Ernesto	*NCDC did not provide a description for this event.*
2005	Hurricane Katrina	*NCDC did not provide a description for this event.*
2004	Tropical Depression Ivan	Countywide flooding and flash flooding with Palmerton Borough and Penn Forest, East Penn and Kidder Townships experiencing the most damage. One fatality.
2003	Hurricane Henri	*NCDC did not provide a description for this event.*
2003	Hurricane Isabel	*NCDC did not provide a description for this event.*
1999	Hurricane Floyd	Countywide flooding including flash flooding.

YEAR	EVENT	DESCRIPTION
1997	Winter Storm*	A coastal storm or Nor'easter developed along the South Carolina coast and moved slowly northeast. Precipitation started during the late evening on November 13th and lasted about 24 hours ending as a period of light snow across much of the area, especially in the Poconos where 1 to 3 inches accumulated on top of the ice.
1985	Hurricane Gloria	Countywide flooding occurred with major damage in Palmerton Borough.
1972	Hurricane Agnes	Countywide flooding occurred.
1955	Hurricane Diane	Countywide flooding occurred with extensive damage in Weissport Borough.
* NCDC's Storm Events Database does not differentiate Nor'easters from other storm events. Therefore, winter storm, winter weather, heavy snow, and strong wind events that included "Nor'easter" in the description were included in this table.		

FIGURE 4.3.4-1 MAP SHOWING HISTORICAL COASTAL STORM EVENTS WHICH TRACKED THROUGH CARBON COUNTY.



4.3.4.4. Future Occurrence

Although hurricanes, tropical storms, and Nor'easters can cause flood events consistent with a 1% annual chance or 0.2% annual chance storm, their probability of occurrence is measured relative to wind speed. Table 4.3.4-3 shows the probability of winds that reach the strength of tropical storms and hurricane conditions in Carbon County and surrounding areas based on a statistical sample region of more than 30,000 square miles over a period of 46 years.

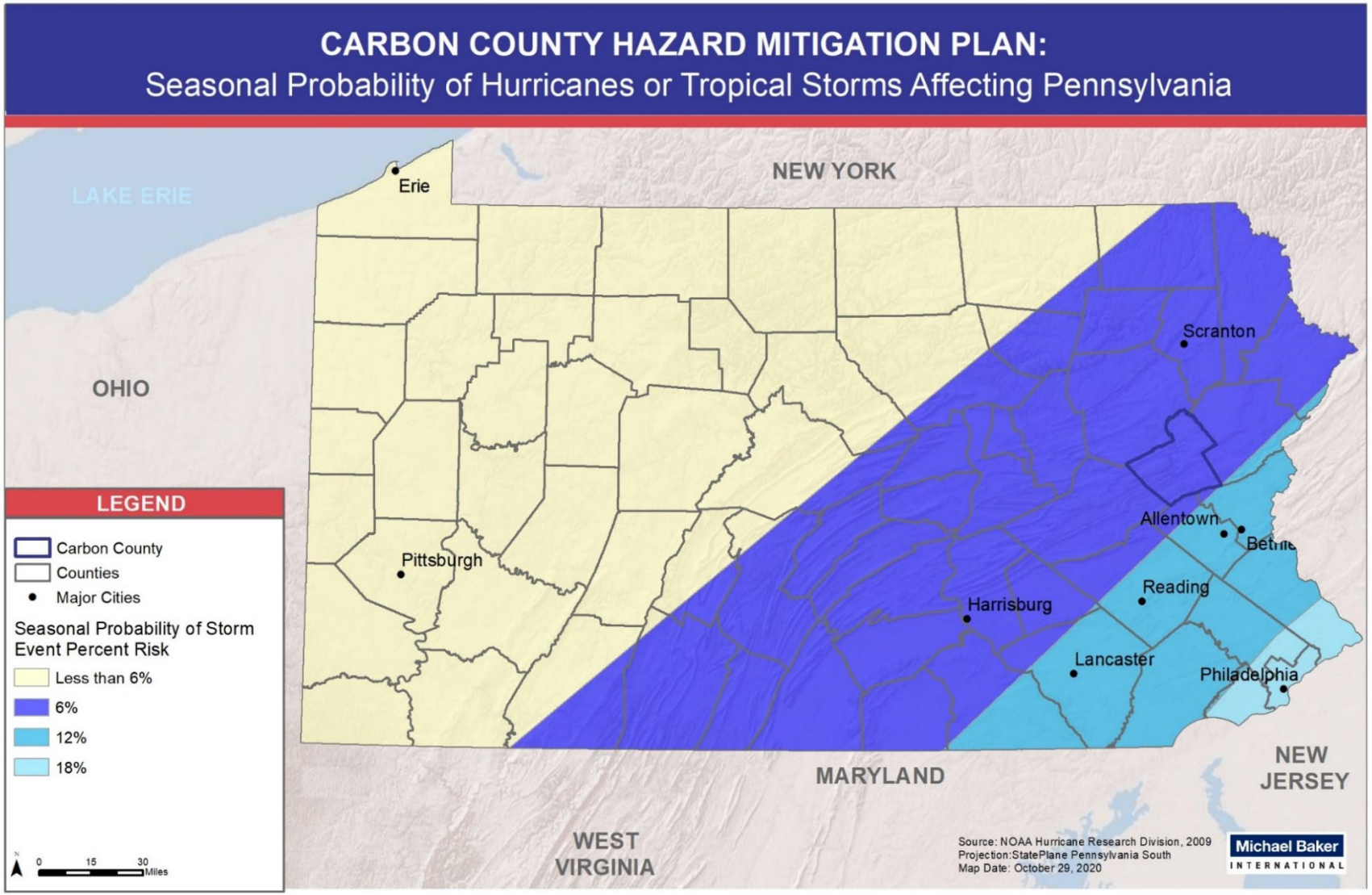
TABLE 4.3.4-3 ANNUAL PROBABILITY OF TROPICAL STORM AND HURRICANE STRENGTH WIND SPEEDS FOR CARBON COUNTY (FEMA, 2000).

WIND SPEED (MPH)	CORRESPONDING SAFFIR-SIMPSON TROPICAL STORM/HURRICANE CATEGORIES	ANNUAL PROBABILITY OF OCCURRENCE (%)
45-77	Tropical Storms and Category 1 Hurricanes	91.59
78-118	Category 1 to 2 Hurricanes	8.32
119-138	Category 3 to 4 Hurricanes	0.0766
139-163	Category 4 to 5 Hurricanes	0.0086
164-194	Category 5 Hurricanes	0.00054
195+	Category 5 Hurricanes	0.00001

Table 4.3.4-3 includes wind speeds for all types of storms and is not specific to cyclonic winds. In Carbon County and surrounding areas, the annual probability for winds that equal the strength of tropical storms (over 39 mph) is over 90 percent. The probability for winds at Category 1 or 2 hurricane strength (78-118 mph) is greater than eight percent in any given year. Using Table 4.3.4-3, these wind speeds correspond to *minimal* or *moderate* expected damages. The annual probability of winds exceeding 118 mph is less than 0.1 percent.

The National Oceanic and Atmospheric Administration Hurricane Research Division published the map shown in Figure 4.3.4-3 showing the chance that a tropical storm or hurricane will affect a given area during the entire Atlantic hurricane season spanning from June to November. Note that this figure does not provide information on the probability of various storm intensities. However, based on historical data between 1944 and 1999, this map reveals there is approximately a six percent chance of experiencing a tropical storm or hurricane event between June and November of any given year in most of the County, or *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

FIGURE 4.3.4-3 SEASONAL PROBABILITY OF A HURRICANE OR TROPICAL STORM AFFECTING CARBON COUNTY.



4.3.4.5. Vulnerability Assessment

A vulnerability assessment for hurricanes, tropical storms, and Nor'easters focuses on the impacts of flooding and severe wind. Carbon County is vulnerable to the flood and wind impacts caused by these types of storms. Historic data indicates that while storm tracks to not typically track over Carbon County, impacts from associated rain can be felt in low-lying communities vulnerable to flooding such as East Penn Borough, Lehighton Borough, Lower Towamensing Township, Mahoning Township, Summit Hill Borough, and Towamensing Township. These communities mainly lie along the Lehigh River and its tributaries. Additionally, Beltzville Lake can be a source of flooding in Towamensing Township. A detailed assessment of Carbon County's flood-related vulnerability is described in Section 4.3.2. Carbon County may also be vulnerable to severe winter weather impacts caused by Nor'easters, as evaluated in Section 4.3.9.

In terms of severe wind-related vulnerabilities, the primary concern is manufactured, or mobile, housing. Additional loss estimation information from hurricane, tropical storm, and Nor'easters in Carbon County is provided in Section 4.4.3, Potential Loss Estimates.

4.3.5. **Landslide**

4.3.5.1. Location and Extent

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation reacting to the force of gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, and changes in groundwater levels. Mudflows, mudslides, rockfalls, rockslides, and rock topples are all forms of a landslide (DCNR, 2020). Landslides usually occur in areas of Carbon County with moderate to steep slopes and during high precipitation. Many slope failures are associated with precipitation events – periods of sustained above-average precipitation, specific rainstorms, or snowmelt events. Areas experiencing erosion, decline in vegetation cover, and earthquakes are also susceptible to landslides. Human activities that contribute to slope failure include altering the natural slope gradient, increasing soil water content, and removing vegetation cover. The geologic instabilities that cause landslides to occur are often exacerbated by highway projects in which the earth is cut, and soil is loosened.

Carbon County is located in the Appalachian Plateaus Province. Here, horizontal rock beds have been cut by streams to form the mountainous terrain distinctive to this region (NPS, 2021). Blue Mountain forms the southern boundary of Carbon County. The northeast area of the county is located in the Pocono Mountains and the northwest area includes portions of Broad and Spring mountains. The Lehigh River cuts a gorge between Jim Thorpe and White Haven, which hosts the Lehigh Gorge State Park (Carbon County, 2013). Slope differences created by these landforms are conducive for landslide occurrence. Figure 4.3.5-1 shows areas of low, moderate, and high landslide susceptibility in Carbon County. This assessment is determined by the most recent public data available through the U.S. Geological Survey from 2001. The northern half of the County is rated as low incidence, with a small portion in the eastern side rated as moderate incidence. The southern half of the County is rated as moderate incidence with high susceptibility. This accounts for over 42% of the total land are in the County. This area includes all or a portion of 21 of 23jurisdictions in the county, listed in Table 4.3.5-1.

FIGURE 4.3.5-1 LANDSLIDE SUSCEPTIBILITY AND INCIDENCE IN CARBON COUNTY, 2001

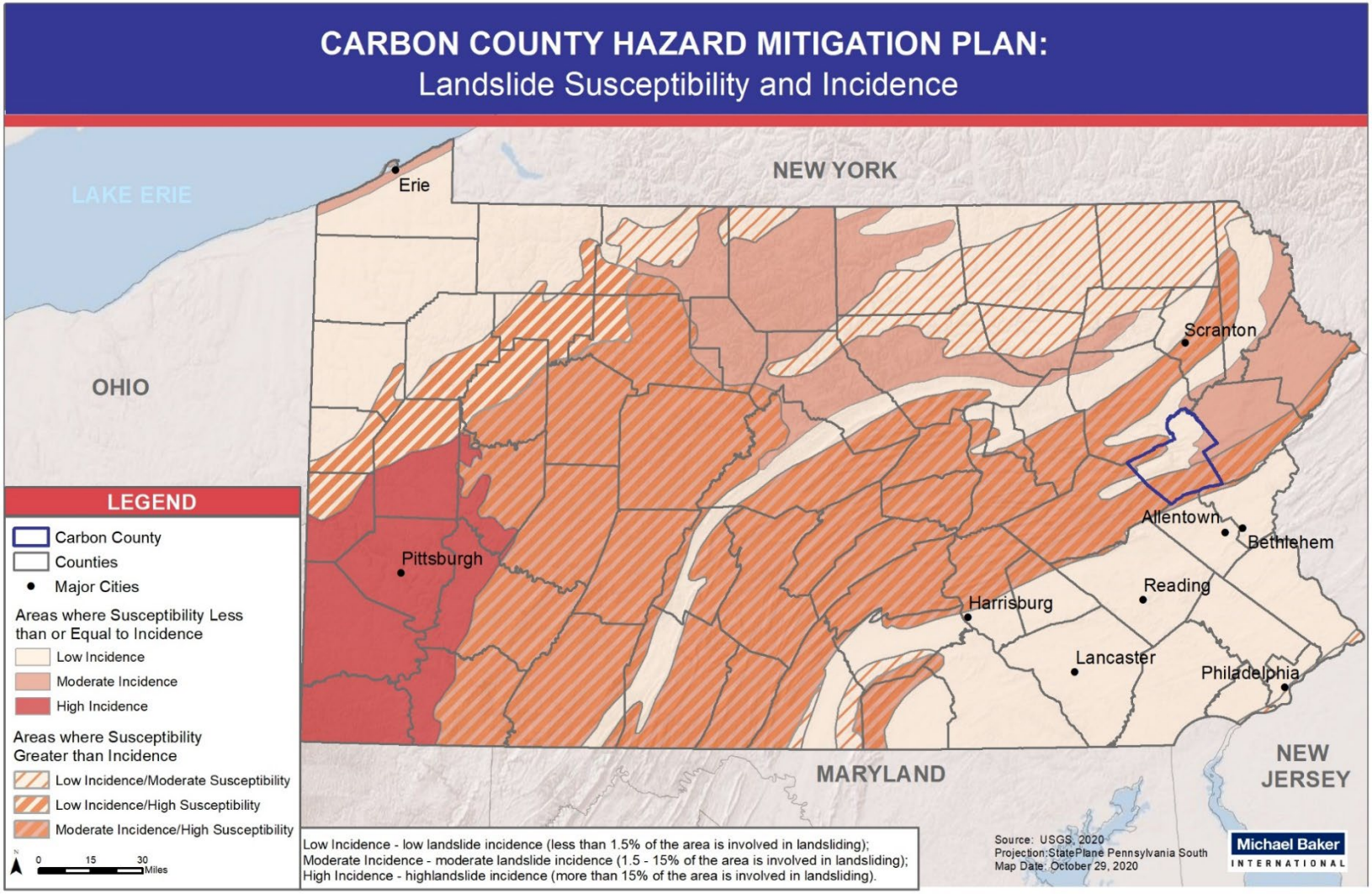


TABLE 4.3.5-1 MUNICIPALITIES LOCATED PARTIALLY OR COMPLETELY IN MODERATE INCIDENCE/HIGH SUSCEPTIBILITY LANDSLIDE ZONES (USGS, 2001).

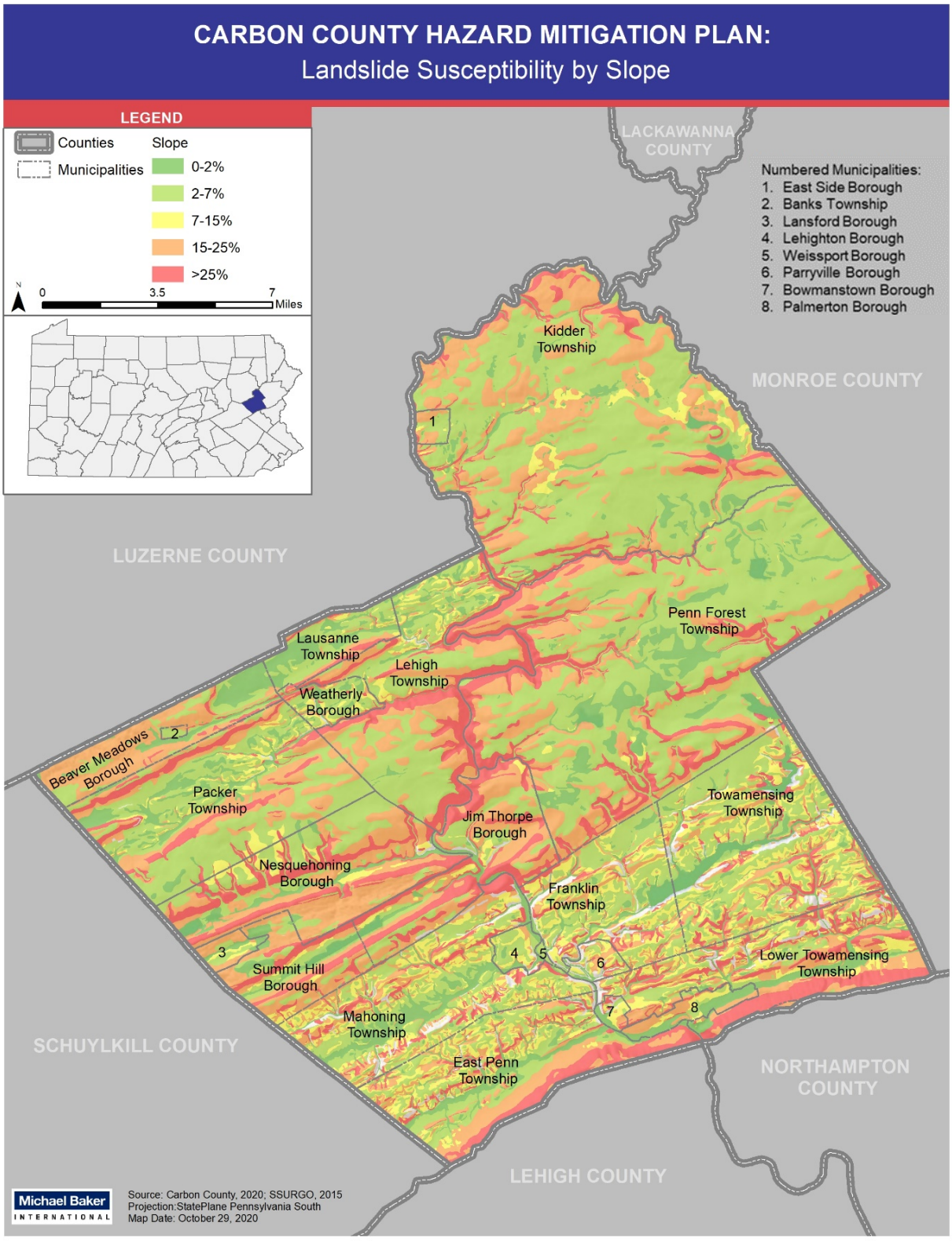
MUNICIPALITY		
Banks Township	Lausanne Township	Palmerton Borough
Beaver Meadows Borough	Lehigh Township	Parryville Borough
Bowmanstown Borough	Lehighton Borough	Penn Forest Township
East Penn Township	Lower Towamensing Township	Summit Hill Borough
Franklin Township	Mahoning Township	Towamensing Township
Jim Thorpe Borough	Nesquehoning Borough	Weatherly Borough
Lansford Borough	Packer Township	Weissport Borough

Figure 4.3.5-2 shows steep slope soils in Carbon County as defined by the most recent data available through the Natural Resources Conservation Service (NRCS). A slop greater than 7 percent (approximately 15°) needs special considerations for building roads according to common engineering practice, and a slop of 15 percent (approximately 25°) is generally unstable and highly sensitive to surface changes. Slopes greater than 25 percent are very unstable. Given the right conditions, a landslide can occur anywhere in Carbon County.

Specific areas in the county that are known to have experienced landslides are:

- Mansion House Hill;
- Maunch Chunk Road in Palmerton Borough;
- Route 209 in Jim Thorpe Borough and Mahoning Township;
- State Route 248 between Parryville Borough and Bowmanstown Borough
- State Route 248 between Palmerton Borough and Lehigh Gap; and,
- Along Turnpike and local roads in North Mountain Areas in Franklin Township and East Penn Township

FIGURE 4.3.5-1 LANDSLIDE SUSCEPTIBILITY BY SLOPE GRADE IN CARBON COUNTY, 2015



4.3.5.2. Range of Magnitude

Landslide velocity can vary from rapid to slow, and the amount of material moving in a landslide can range from a relatively small amount to a large amount. Landslides can include falling, sliding, or flowing of rocks and soil or a combination of these different types of motion.

The impact of landslides on the environment depends on the size and specific location of the event. In general, impacts include

- Changes to topography
- Damage or destruction to vegetation
- Potential diversion of blockage of water in the vicinity of streams, rivers, etc.
- Increased sediment runoff both during and after an event

Landslides cause damage to transportation routes, utilities, and buildings and create travel delays and other side effects. Fortunately, deaths and injuries due to landslides are rare in Pennsylvania. Almost all known deaths due to landslides have occurred when rockfalls or other slides along highways have involved vehicles. Storm-induced debris flows are the only other type of landslide likely to cause death and injury. Heavy rain and floods can lead to landslides in areas with loose soil and/or steep slopes. Damage to infrastructure and the natural environment is exacerbated as flood and landslide hazard compound on one another. Flood, Flash Flood, and Ice Jam events are described in detail in Section 4.3.2. As residential and recreational development increases on and near steep mountain slopes, the hazard from these rapid events will also increase. Most landslides in Pennsylvania are moderate to slow moving and damage property rather than people. The Pennsylvania Department of Transportation and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in known landslide-prone areas.

No serious injury, death or substantial property damage has occurred in Carbon County as a result of a landslide incident. Typically, the worst level of damage caused by landslides in the county is minor property damage to vehicles, damage to roads resulting in temporary road closures, and minor personal injury. A possible worst-case scenario would occur if there was a large landslide on Route 209 in Jim Thorpe or Mahoning Township. This road is a main access point to the Pennsylvania Turnpike's Northeast Extension; a rockfall on Route 209 has the potential to cause material damage and injury as well as economic losses because the County's commerce would be interrupted for an unknown period of time.

4.3.5.3. Past Occurrence

A comprehensive inventory of landslide events in Pennsylvania does not exist. The NCDC database captures landslides as they occur in conjunction with severe storms. In March 2002, heavy snow and rain caused a rockslide five miles north of Jim Thorpe. Rocks slid onto the tracks of the Northfork Southern Railroad, but caused no injuries or significant damage. In June 2006, heavy rain and flooding throughout the County caused at least one mudslide that damaged a home. In May 2012, heavy rain and flash flooding caused a rockslide on Maunch Chunk Road in Palmerton (NOAA NCEI, 2021).

Areas within the County that have a known history of landslides are listed in Section 4.3.5.1. Based on anecdotal information from the County and municipal officials, minor landslides occur each year, typically during periods of heavy rains. These events have caused minor damages and personal injuries, but no deaths. Landslides with minor impact are defined as landslides impacting five or less developed properties or causing $1,000,000 or less damage. Minor landslides are typically in remote locations causing little to no damage.

Since landslides often occur during periods of heavy rain or snowmelt, it is possible to examine past occurrences of these events. At least 77 of these events have been recorded by NCEI since 1996, which are shown in Table 4.3.5-2.

TABLE 4.3.5-2 HEAVY RAIN AND HEAVY SNOW EVENTS IN CARBON COUNTY (NOAA NCEI, 2021)

LOCATION	DATE	TYPE	LOCATION	DATE	TYPE
Countywide	1/12/1996	Heavy Snow	Countywide	3/2/2002	Heavy Rain
Countywide	7/12/1996	Heavy Rain	Countywide	3/20/2002	Heavy Snow
Countywide	10/8/1996	Heavy Rain	Countywide	3/21/2002	Heavy Snow
Countywide	12/5/1996	Heavy Snow	Countywide	10/10/2002	Heavy Rain
Countywide	12/7/1996	Heavy Snow	Countywide	10/29/2002	Heavy Snow
Countywide	12/13/1996	Heavy Snow	Countywide	11/26/2002	Heavy Snow
Countywide	12/31/1996	Heavy Rain	Countywide	12/5/2002	Heavy Snow
Countywide	12/31/1996	Heavy Rain	Countywide	2/6/2003	Heavy Snow
Countywide	3/31/1997	Heavy Snow	Countywide	2/16/2003	Heavy Snow
Countywide	4/1/1997	Heavy Snow	Countywide	5/31/2003	Heavy Rain
Countywide	6/1/1997	Heavy Rain	Countywide	6/1/2003	Heavy Rain
Countywide	12/10/1997	Heavy Snow	Countywide	10/27/2003	Heavy Rain
Countywide	3/8/1998	Heavy Rain	Countywide	11/19/2003	Heavy Rain
Countywide	5/8/1998	Heavy Rain	Countywide	12/11/2003	Heavy Rain
Countywide	10/8/1998	Heavy Rain	Countywide	3/18/2004	Heavy Snow
Countywide	1/3/1999	Heavy Rain	Hickory Run	8/1/2004	Heavy Rain
Countywide	1/31/1999	Heavy Rain	Countywide	11/28/2004	Heavy Rain
Countywide	3/14/1999	Heavy Snow	Countywide	1/22/2005	Heavy Snow
Albrightsville	5/19/1999	Heavy Rain	Countywide	2/28/2005	Heavy Snow
Countywide	8/13/1999	Heavy Rain	Countywide	3/1/2005	Heavy Snow
Countywide	9/30/1999	Heavy Rain	Countywide	12/9/2005	Heavy Snow
Countywide	1/13/2000	Heavy Snow	Albrightsville	11/8/2006	Heavy Rain
Countywide	1/20/2000	Heavy Snow	Countywide	3/16/2007	Heavy Snow
Countywide	1/25/2000	Heavy Snow	Countywide	11/18/2007	Heavy Snow
Countywide	1/30/2000	Heavy Snow	Albrightsville	3/5/2008	Heavy Rain
Countywide	2/3/2000	Heavy Snow	Albrightsville	10/25/2008	Heavy Rain
Countywide	3/21/2000	Heavy Rain	Countywide	10/27/2008	Heavy Snow
Countywide	4/9/2000	Heavy Snow	Countywide	10/29/2011	Heavy Snow
Countywide	12/19/2000	Heavy Snow	Countywide	1/2/2014	Heavy Snow
Countywide	1/5/2001	Heavy Snow	Countywide	2/3/2014	Heavy Snow
Countywide	1/8/2001	Heavy Snow	Lansford	10/15/2014	Heavy Rain
Countywide	1/20/2001	Heavy Snow	Countywide	1/23/2015	Heavy Snow
Countywide	2/5/2001	Heavy Snow	Ashfield	9/19/2016	Heavy Rain
Countywide	2/22/2001	Heavy Snow	Little Gap	9/19/2016	Heavy Rain
Countywide	3/9/2001	Heavy Snow	Lehighton	7/7/2017	Heavy Rain
Normal Square	9/24/2001	Heavy Rain	Lehighton	7/7/2017	Heavy Rain
Countywide	1/6/2002	Heavy Snow	Black Creek JCT	8/1/2017	Heavy Rain
Countywide	1/7/2002	Heavy Snow	Black Creek JCT	8/1/2017	Heavy Rain

LOCATION	DATE	TYPE	LOCATION	DATE	TYPE
Countywide	1/19/2002	Heavy Snow			

4.3.5.4. Future Occurrence

Significant landslide events are unlikely in Carbon County. However, there is the possibility of some rock falling from a steep slope, given that this has occurred several times in the past. These events are expected to be small, and cause little to no damage. The probability of large-scale future landslide events in Carbon County is considered possible due to the County's position over the Appalachian mountain section physiographic province. This is a geological formation with moderate to high landslide potential. Mismanaged intense development in steeply sloped areas could increase their frequency of occurrence. Building and road construction are contributing development factors to landslides as they can often undermine or steep otherwise stable soil. Additionally, an increase in rain events could lead to an increase in landslide due to erosion, poor drainage, etc. The probability of future landslide events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.5.5. Vulnerability Assessment

Landslides can result in the disruption of roads, water, sewer, gas, electric, and phone lines, as well as serious damage to public and private property. The loss of life likely to happen in such an occurrence would be a major concern, particularly for those areas where multi-family construction has taken place. While the majority of development in Carbon County is not particularly vulnerable to landslides, any landslide events that do occur would take place in steeply sloped areas. In addition, places where landforms have been altered for purposes of highway construction or other development may be uniquely vulnerable to landslide hazards. This is especially true if development is located at the base or crest of cliffs or near large highway cut-outs. These areas should be considered vulnerable to landslides, particularly if mitigation measures have not been implemented. Additionally, increased deforestation and soil disturbances caused by development on sloped areas may further increase these risks. As timbering and development of sloped land continues, the risk of significant landslides increases.

Table 4.3.5-3 details the amount of structures and critical facilities in each municipality that are in an area of landslide susceptibility over 15%. As the table shows, over sixteen percent of all structures, and over 21 percent of critical facilities, are in these areas of high susceptibility. There are three municipalities with over 25 percent of their structures in these areas: East Side Borough, Lehigh Township, Nesquehoning Borough, and Parryville Borough. Penn Forest Township has the most structures in these areas – 944 structures – however, this is just over 13 percent of their total structures. Only Weissport Borough has no structures in these areas of high susceptibility, but Beaver Meadows Borough and Lansford Borough also have less than five percent of their structures in these areas.

Reported in the 2015 plan, there were four municipalities with fifty percent or more of their critical facilities in these areas of high susceptibility: Packer Township Lausanne Township, Banks Township, and Nesquehoning Borough. However, as of the 2021 update, there were no municipalities that had higher than 48 percent (Jim Thorpe Borough). Jim Thorpe Borough has the highest number of critical facilities within these areas, 13 critical facilities, which is 48 percent of their total critical facilities. Ten municipalities have no critical facilities within these

areas of high susceptibility. For a complete list of critical facilities and their vulnerability to landslide hazards, please see Appendix E.

TABLE 4.3.5-3 STRUCTURES AND CRITICAL FACILITIES VULNERABLE TO LANDSLIDES.

Municipality	Total Structures	Total Structures on Slopes Over 15%	Percent Structures on Slopes Over 15%	Total Critical Facilities	Critical Facilities on Slopes Over 15%	Percent Critical Facilities on Slopes Over 15%
Banks Township	655	131	20%	8	3	38%
Beaver Meadows Borough	441	10	2%	2	0	0%
Bowmanstown Borough	428	28	7%	4	0	0%
East Penn Township	1,552	285	18%	10	4	40%
East Side Borough	322	111	34%	1	0	0%
Franklin Township	2,207	388	18%	13	1	8%
Jim Thorpe Borough	2,473	516	21%	25	12	48%
Kidder Township	3,736	915	24%	36	13	36%
Lansford Borough	2,096	8	0%	5	0	0%
Lausanne Township	132	17	13%	3	1	33%
Lehigh Township	289	79	27%	7	0	0%
Lehighton Borough	2,383	534	22%	12	0	0%
Lower Towamensing Township	1,540	376	24%	8	2	25%
Mahoning Township	1,989	373	19%	11	0	0%
Nesquehoning Borough	1,646	589	36%	17	6	35%
Packer Township	512	86	17%	5	2	40%
Palmerton Borough	2,328	220	9%	13	0	0%
Parryville Borough	311	77	25%	4	1	25%
Penn Forest Township	7,200	944	13%	21	2	10%
Summit Hill Borough	1,496	94	6%	8	1	13%
Towamensing Township	1,980	248	13%	20	4	20%
Weatherly Borough	1,009	133	13%	7	0	0%
Weissport Borough	173	0	0%	3	0	0%
Grand Total	**36,898**	**6,162**	**17%**	**243**	**52**	**21%**

4.3.6. Pandemic & Infectious Disease

4.3.6.1. Location and Extent

Pandemic is defined as a disease affecting or attacking the population of an extensive region, including several countries, and/or continent(s). It is further described as extensively epidemic. Generally, pandemic diseases cause sudden, pervasive illness in all age groups on a global scale. Infectious diseases are also highly virulent but are not spread person-to-person.

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

Influenza, also known as "the flu," is a contagious disease that is caused by the influenza virus and most commonly attacks the respiratory tract in humans. Influenza is considered to have pandemic potential if it is novel, meaning that people have no immunity to it, virulent, meaning that it causes deaths in normally health individuals, and easily transmittable from person-to-person.

Different strands of influenza mutate over time and replace older strands of the virus and thus have drastically different effects. The H1N1 virus, colloquially known as swine flu, is of particular concern. This virus was first detected in people in the United States in April 2009. On June 11, 2009, the World Health Organization signaled that a pandemic of 2009 H1N1 flu was underway (CDC, 2009a). Avian influenza, also known as bird flu, infects birds. A recent strain, H5N1, has caused particular concern due to its ability to pass from wild birds to poultry to people. This virus has killed more than half of the people infected with in, although the avian flu is less likely to infect humans.

During this HMP Update process, Carbon County is one year into a worldwide pandemic caused by a novel coronavirus. Named COVID-19, this type of coronavirus is a new virus that causes respiratory illness and is extremely contagious. Flu-like in nature, symptoms of the virus include fever, cough, shortness of breath, and diarrhea. This virus became a great concern due to its high rates of transmission, and high incidence of mortality in addition to so little being known about it. Severe reactions that require immediate medical care include trouble breathing, persistent pain or pressure in the chest, new confusion, inability to wake or stay awake, and discolored skin, lips, or nail beds. In extreme COVID-19 cases that require hospitalization, patients require ventilators to support breathing and may pass away from the virus or related reasons (CDC, 2021a).

Governor Tom Wolf issued the first stay-at-home order on March 23, 2020 for seven counties which was then expanded to all 67 counties in the Commonwealth on April 1st. Schools were moved to virtual settings, non-essential businesses were closed, and all essential state services were continued operation (Governor Tom Wolf, 2020). Carbon County adopted all state-level restrictions and guidelines to slow the spread of the virus. On May 31, 2021, the stay-at-home order and any other mitigation order except fact mask wearing for the Commonwealth of Pennsylvania was lifted (VisitPA, 2021). People were advised to practice social distancing; only leaving the house for essentials like grocery shopping, and no gathering even in small groups.

Even when going on walks, health care professionals recommended that individuals wear masks and remain six feet apart to slow the spread of transmission. At least three new variants of the virus have been detected globally, each reaching the United States by January 2021 (CDC, 2021a). According to data collected and compiled daily by the New York Times, at least 1 in 10 Carbon County residents have been infected with COVID-19. The PADOH facilitated a testing site clinic in Carbon County. The drive-thru testing site for COVID-19 was free to the public and was located at Beltzville State Park from January 20, 2021 to January 24, 2021, just inside the main entrance. Lehigh Valley Health Network had also set up testing sites throughout the region, one located in Palmerton Borough in Carbon County. Additional testing sites continued to operate in neighboring counties as well.

Starting January 2021, vaccines were being distributed in phases based off of vulnerable populations as well as those who are frequently exposed (PA DOH, 2021a):

- Phase 1A: long-term care facility residents, health care personnel, persons ages 65 and older, persons ages 16-64 with high-risk conditions defined by the CDC, and persons potentially exposed to infectious material that can transmit disease to healthcare personnel and patients, teachers, child-care workers, and frontline groups.
- Phase 1B: Opened on April 5, 2021 – people in congregate settings that are not specified as long-term care facilities, persons receiving home and community-based services, correctional officers and other workers serving people in congregate care settings not included in Phase 1A, education workers not covered in Phase 1A – including those in higher education, U.S. Postal Service workers, manufacturing workers, clergy and other essential support for houses of worship, and public transit workers.
- Phase 1C: Opened on April 12, 2021 – essential workers in transportation and logistics, water and wastewater, food service, housing construction, finance including bank tellers, information technology, communications, energy including nuclear reactors, legal services, federal, state, county, and local government workers including County election workers, elected officials, and members of the judiciary and their staff, media, public safety, and public health workers.
- Phase 2: Opened on April 13, 2021 – all individuals not previously covered who are 12 and older and do not have a contraindication to the vaccine are eligible.

The three vaccines that received emergency approval by the U.S. Food and Drug Administration (FDA) include the Pfizer-BioNTech vaccine, the Johnson & Johnson-Janssen vaccine, and the Moderna vaccine. Each vaccine requires a 15-30-minute on-site observation period after receiving the vaccine. The Pfizer-BioNTech and Moderna vaccine requires two shots for immunity; the Johnson & Johnson-Janssen vaccine is a one-shot vaccine. All three vaccines take two weeks after the final shot to be considered fully vaccinated against COVID-19 (CDC, 2021c). As Carbon County, and the rest of the nation, continue to get vaccinated during the pandemic, there have been issues with some of those who chose to receive the two-step vaccines with not returning to receive the second dose for full inoculation. In part to widespread misinformation, and a temporary pause in the Johnson & Johnson administration, there are individuals who are choosing not to receive the vaccine. There is a growing concern

about a potential additional peak of COVID-19 infections and deaths in this unvaccinated population.

4.3.6.2. Range of Magnitude

The magnitude of a pandemic or infectious disease threat in Carbon County will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is easily transmitted from person-to-person, but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. The magnitude of a pandemic may be exacerbated by the fact that an influenza pandemic will cause outbreaks across the United States, limited the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventative and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available.

In terms of lives lost, the impact various pandemic influenza outbreaks have had globally over the last century has declined (see Table 4.3.6-1). The severity of illness from the 2009 H1N1 influenza flu virus varied, with the gravest cases occurring mainly among those considered to be high risk. High-risk population that are considered more vulnerable include children, the elderly, pregnant women, and chronic disease patients with reduced immune system capacity. These populations are described in more detail in Section 4.3.6.5. Most people infected with swine flu in 2009 recovered without needing medical treatment (CDC, 2009b). Unlike regular flu season, according to the Centers for Disease Control and Prevention (CDC) the overwhelming majority of the people who died, as many as 77 percent, were 18 to 64 years old with up to 11 percent of the deaths estimated in those 17 years old and younger.

The 1918 Spanish flu pandemic was the worst-case pandemic event in the 20th century for both Pennsylvania and worldwide. County data is unavailable, and mortality figures were probably under-reported, though it is recorded that there were over 60,000 deaths in the Commonwealth (Shetty & Ahern, 2018). Infection rates were much worse in denser cities, which should be a high priority for response actions in future flu events.

Avian bird flu was at a high in Pennsylvania in 1983 and 1984, resulting in the loss of 17 million birds, which equated to a loss of $65 million in economic activity (Smith, 2015). An event of a similar scale would be a worst-case scenario for avian flu in Carbon County.

Carbon County has faced varying impacts of the COVID-19 pandemic. It is believed that the virus originated in an open-air market in the Wuhan province of China in November 2019. Shortly afterwards, the virus began to spread to nearby countries including Japan and South Korea. By March 2020, the virus had reached almost every country worldwide, with the most cases in the United States. At first, concern was focused on people who might be infected due to recent travel. However, community infections soon began to crop up in many cities and towns. This led to a statewide shutdown of schools and businesses and the cancellation of large events for the remainder of 2020. Only life sustaining services were permitted to remain open, including medical facilities, pharmacies, and grocery stores. People were advised to remain home as much as possible in an attempt to slow the transmission of COVID-19. State health officials note that the virus has infected ass age ranges at about the same rate, and that no age group can be considered more or less vulnerable to infection. New variants of the virus reached the United States in January 2021. The CDC notes that these variants spread more easily and quicker than other variants, which may lead to a rapid increase in COVID cases (CDC, 2021a). It is currently unknown how new variants will interact with existing vaccines.

4.3.6.3. Past Occurrence

The United States Department of Health and Human Services estimates that influenza pandemics have occurred for at least 300 years at unpredictable intervals. There have been several pandemic influenza outbreaks over the past 100 years. A list of events and worldwide deaths are shown in Table 4.3.6-1.

TABLE 4.3.6-1 SIGNIFICANT INFLUENZA OUTBREAKS OVER THE PAST CENTURY (GLOBAL SECURITY, 2009; WHO, 2009).

DATE	PANDEMIC	WORLDWIDE DEATHS (APPROXIMATE)
1918-1920	Spanish Flu/H1N1	50 million
1957-1958	Asian Flu/H2N2	1.5-2 million
1968-1969	Hong Kong Flu/H3N2	1 million
2009-2010	Swine Flu/H1N1	12,000

Deaths occurred in the United States as a result of the Spanish Flu, Asian Flu, and Hong Kong Flu outbreaks. The Spanish Flu claimed 500,000 lives in the United States. There were 350,000 cases and 8,000 deaths in Pennsylvania. Most deaths resulting from the Asian flu occurred between September 1957 and March 1958; there were about 70,000 deaths in the United States and approximately 15 percent of the population of Pennsylvania was affected. The first cases of the Hong Kong Flu in the United States were detected in September 1968 with deaths peaking between December 1968 and January 1969 (Global Security, 2009).

Table 4.3.6-2 lists the number of seasonal flu cases in Carbon County from the 2014/2015 flu season. A sharp decrease of total cases was seen during the 2015/2016 flu season after the County opened a flu vaccine clinic. There has been an increase in cases each season in recent years. The sharp increase in cases for the 2019/2020 season may be related to COVID-19 (CDC, 2021b). The CDC notes that due to COVID, there was an overall increase in the number of flu tests. This reveals that there may be undetected cases in the county each year, so an increase in total tests very likely leads to an increase in number of flu cases (CDC, 2020).

TABLE 4.3.6-2 NUMBER OF FLU CASES IN CARBON COUNTY BY FLU SEASON (PA DOH, 2020A)

FLU SEASON	# OF CASES
2014/2015	306
2015/2016	131
2016/2017	419
2017/2018	422
2018/2019	489
2019/2020	728

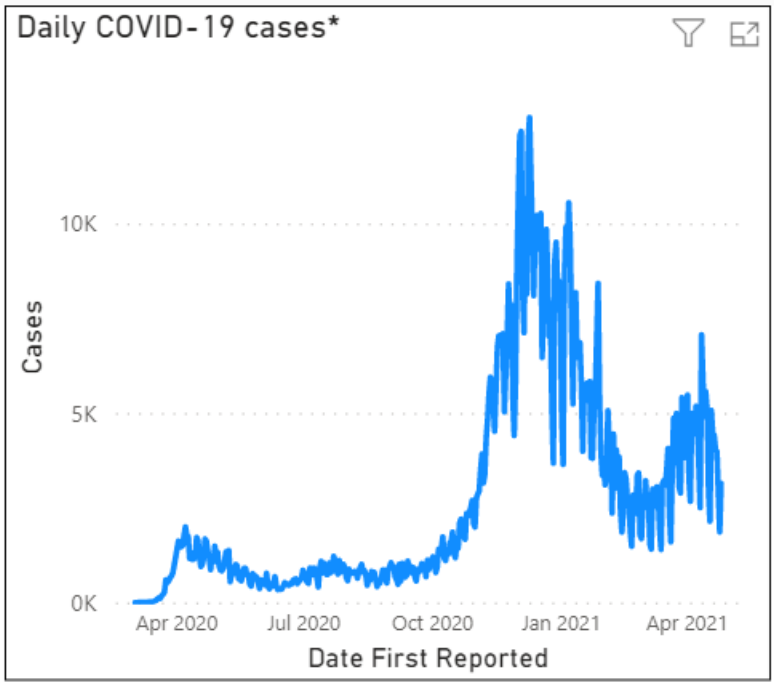
An avian flu outbreak in Pennsylvania occurred in 1983 through 1984, in which 17 million birds were lost. There has not been an outbreak since in the Commonwealth, although there have recently been outbreaks in the Midwest. From 1996 to 1997, a number of table-egg farms in Lancaster and Lebanon Counties tested positive for H7N2 avian influenza. As a result, nine flocks were lost, and the Pennsylvania Department of Agriculture (PADA) imposed a

quarantine on a 75-square-mile area restricting movement of poultry or poultry products into or out of the area (Jacob et al., 1998).

The COVID-19 outbreak began in China in November in 2019. The virus reached the United States in late February 2020, and most counties in Pennsylvania were affected by March 2020. As of April 28, 2021, there were more than 1,139,390 confirmed cases in Pennsylvania, with 5,999 cases and 165 deaths reported in Carbon County (PA DOH, 2021c). Case numbers were first expected to peak in May 2020; however, the Commonwealth experienced the largest number of cases in December 2020, with over 12,700 cases. The Commonwealth is experiencing its third peak in cases as of April 2021. As more people receive the vaccine it is expected that case numbers will decrease.

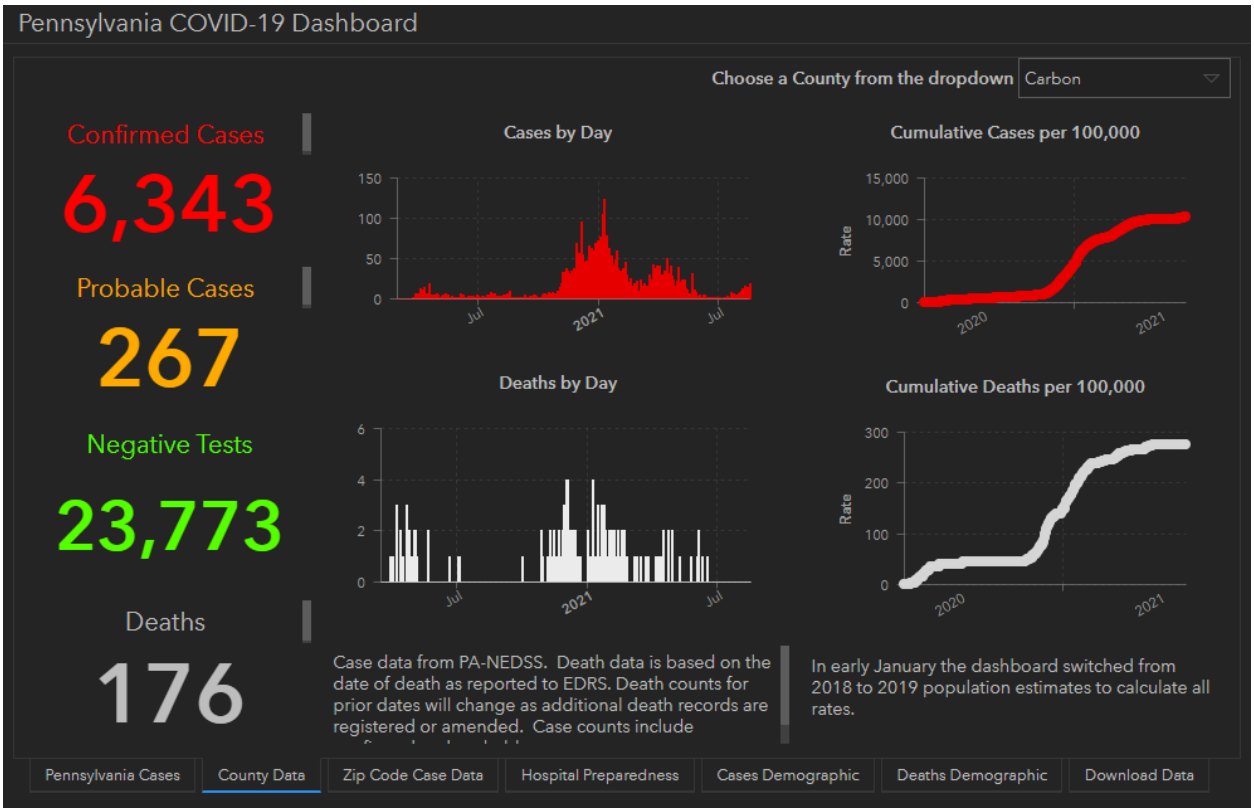
As of August 17, 2021, there were more than 1,253,992 confirmed cases in Pennsylvania, with 6,343 cases and 176 deaths reported in Carbon County (PA DOH, 2021b) (see Figure 4.3.6-1). Case numbers were first expected to peak in May 2020; however, the Commonwealth experienced the largest number of cases in December 2020, with over 12,700 cases. The Commonwealth was experiencing its third peak in cases in April 2021. However, case numbers have drastically decreased since then (see Figure 4.3.6-2). As more people receive the vaccine it is expected that case numbers will decrease. As of July 24, 2021, 62,515 vaccinations have been administered in Carbon County; 31,787 people have full COVID-19 vaccine coverage and 30,728 people have partial coverage (PA DOH, 2021a).

FIGURE 4.3.6-1 NUMBER OF COVID-19 CASES IN PENNSYLVANIA FROM APRIL 2020 TO APRIL 2021 (PA DOH, 2021C).



* Cases include confirmed and probable cases

FIGURE 4.3.6-2 NUMBER OF COVID-19 CASES IN CARBON COUNTY, PENNSYLVANIA FROM THROUGH AUGUST 17, 2021 (PA DOH, 2021C).



4.3.6.4. Future Occurrence

Future occurrences of pandemics and infectious diseases are unclear. The precise timing of pandemic influenza in uncertain, but occurrences are most likely when the Influenza Type A virus makes a dramatic change, or antigenic shift, that results in a new or "novel" virus to which the population has no immunity. This emergence of a novel virus is the first step toward a pandemic. Future pandemics may also emerge from other diseases, especially invasive pathogens that Pennsylvanians do not have natural immunity to. While it is unlikely that pandemics and infectious diseases will affect the county, this hazard occurred recently in Spring 2020. It is impossible to predict this type of hazard. The best form of county response is to expect that these events can occur at any time and to constantly evaluate resources and update local and county emergency response plans. The Community Emergency Response Team (CERT) and the community alert system that emergency management personnel can use to notify residents of important information during a major crisis or emergency impacting the County can both be utilized to respond to pandemic and infectious disease events, such as testing or vaccination clinics.

Looking at the number of historical incidences of pandemic-potential diseases, the possibility of future pandemic events can be considered *likely* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.6.5. Vulnerability Assessment

Certain population groups are at higher risk of pandemic flu infection. This population group includes people 65 years and older, children younger than five years old, pregnant women, and people of any age with certain chronic medical conditions. Such conditions include but

are not limited to diabetes, heart disease, asthma, and kidney disease (CDC, 2021c). Schools, colleges, convalescent centers, and other institutions serving those younger than five years old and older than 65 years old, are locations conducive to faster transmission of pandemic influenza since populations identified as being at high risk are concentrated at these facilities or because of a large number of people living in close quarters. Pennsylvania DOH tracks the number of COVID-19 cases associated with nursing homes and personal care homes. Carbon County to date (August 17, 2021) has eight facilities with cases. Of the residents within these eight facilities, 457 tested positive for COVID-19. 63 employees tested positive for COVID-19. There have been 113 deaths.

All communities in Carbon County are considered vulnerable to a pandemic event, with the likely greatest impact in terms of population affected and disruption of economic activity occurring in Jim Thorpe, the County seat. There are some occupation-specific risks that may make some employees more vulnerable. For example, those working in direct patient care situations are more likely to be exposed to a pandemic disease.

There are no true environmental impacts of pandemics and infectious disease threats, but there will be significant economic and social costs beyond the possibility of disease-related deaths. Widespread illness may increase the likelihood of shortages of personnel to perform essential community services. In addition, high rates of illness and worker absenteeism occur within the business community, and these contribute to social and economic disruption. Social and economic disruptions could be temporary but may be amplified in today's closely interrelated and interdependent systems of trade and commerce. Social disruption may be greatest when rates of absenteeism impair essential services, such as power, transportation, and communications.

Jurisdictional losses in a pandemic or infectious disease outbreak stem from lost wages and productivity, not losses to buildings or land. Losses are difficult to estimate because the exact rates of absenteeism and cost of treating a widespread disease will depend on the virus or bacterium in question, the availability of vaccination or treatment, and the severity of symptoms. For historical context, though, the Asian and Hong Kong Flu pandemics killed over 1.5 million people worldwide and caused an estimated $32 billion losses due to lost productivity and medical expenses (Saunders-Hastings & Krewski, 2016). With Pennsylvania's economy integral to the national economy, economic losses from a pandemic or infectious disease threat could be significant.

An avian flu outbreak could cause some economic loss for poultry farmers in Carbon County. According to the 2017 Agricultural census, livestock sales make up about 12% of Carbon County's agricultural sales. Poultry and egg sales totaled around $13,000 in 2017 (USDA, 2017).

It is currently unknown how COVID-19 will change the economic environment long term. However, it is expected that there will be immense losses due to the COVID-19 pandemic. Thousands of individuals were laid off across the commonwealth as non-essential businesses were forced to close. In just one week, over three million Americans filed for unemployment; the greatest amount ever. The accommodation and food services industry suffered the highest number of jobs lost. Professional services, construction, and manufacturing have all been subsidized at greater rates, allowing for lower amounts of jobs lost. Tourism and hospitality industries have suffered in high density areas; however, remote destinations in Carbon County are less susceptible to this trend as they are deemed safe to visit. The majority of COVID-19 aid packages have been distributed to allow some industries to continue operations (Klein &

Smith, 2021). Concerns during vaccination distribution were raised due to the rural nature of Carbon County. Carbon County is rural, without a large mass public transportation network. Determining the location of vaccine distribution centers is a challenge in rural areas where residents would be required to drive to a site.

The COVID-19 pandemic has also spurred conversations around creating safe public spaces and work environments in regard to pandemic and infectious disease. The International Code Council (ICC) published an overview of code compliance that helps facilitate response to pandemic instances. For example, properly designed, installed, and maintained ventilation systems can help in mitigating the spread of pathogens (ICC, 2020). Many buildings have chosen to inspect and upgrade these systems during shelter in place orders. This is essential towards stopping the spread of pathogens in high density residential buildings and ensures workers will return to a safe environment when it is safe to work in offices again.

Carbon County Community Foundation (CCCF) has joined forces with area funders to create the Greater Lehigh Valley COVID-19 Community Response Fund which aims to strengthen safety-net services for community members who are disproportionately impacted by COVID-19 in Lehigh, Northampton and Carbon counties. In Carbon County, this includes older adults, people who are experiencing poverty or homelessness, and families who live paycheck to paycheck.

CCCF focuses on improving quality of life for residents of the Carbon region, and as such, any funds committed or raised by CCCF will be put to use in the Carbon County area. All partners are committed to distributing 100% of funds to directly support community organizations.

Guided by a community-led strategic response team, one-time general operating grants will be awarded on a rolling basis. The first phase will focus on providing rapid and direct support to organizations that provide critical safety-net services including:

- Services that are providing food access
- Services for unsheltered residents and those at risk of homelessness
- Supports for those who are economically vulnerable to mitigate the effects of reduced hours or lost jobs

Future phases will address broader intermediate and long-term needs and are contingent on the availability of funds.

4.3.7. Radon Exposure

4.3.7.1. Location and Extent

Radioactivity caused by airborne radon has been recognized for many years as an important component in the natural background radioactivity exposure of humans, but it was not until the 1980s that the wide geographic distribution of elevated values in houses and the possibility of extremely high radon values in houses were recognized. In 1984, routine monitoring of employees leaving the Limerick nuclear power plant near Reading, PA while it was still under construction and not yet functional, showed that readings on a construction worker at the plant frequently exceeded expected radiation levels. However, only natural, nonfission-product radioactivity was detected on him.

Subsequent testing of the employee's home in the Reading Prong section of Pennsylvania showed extremely high radon levels around 2,500 pCi/L (pico Curies per Liter). To put this amount in perspective, the Environmental Protection Agency (EPA) guidelines state that actions should be taken if radon levels exceed 4 pCi/L in a home, and uranium miners have a

maximum exposure of 67 pCi/L. As a result of this event, the Reading Prong became the focus of the first large-scale radon scare in the world.

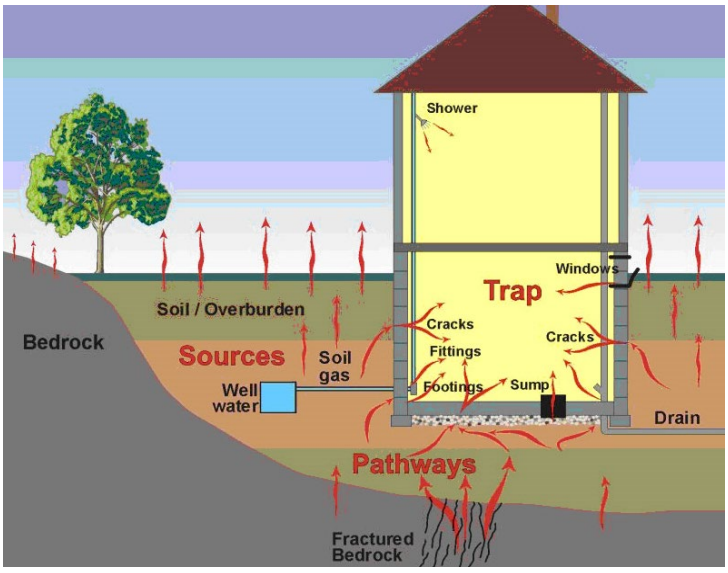
Radon is a gas that cannot be seen or smelled. It is a noble gas that originates by the natural radioactive decay of uranium and thorium. Like other noble gases (e.g., helium, neon, and argon), radon forms essentially no chemical compounds and tends to exist as a gas or as a dissolved atomic constituent in groundwater. Two isotopes of radon are significant in nature, 222Rn and 220Rn, formed in the radioactive decay series of 238U and 232Th, respectively. The isotope thoron (i.e. 220Rn) has a half-life (time for decay of half of a given group of atoms) of 55 seconds, barely long enough for it to migrate from its source to the air inside a house and pose a health risk. However, radon (i.e. 222Rn), which has a half-life of 3.8 days, is a widespread hazard.

The distribution of radon is correlated with the distribution of radium (i.e. 226Ra), its immediate radioactive parent, and with uranium, its original ancestor. Due to the short half-life of radon, the distance that radon atoms can travel from their parent before decay is generally limited to distances of feet or tens of feet.

Three sources of radon are now recognized in houses (shown in Figure 4.3.7-1):

- Radon in soil air that flows into the house;
- Radon dissolved in water from private wells and exsolved during water usage; this is rarely a problem in Pennsylvania; and
- Radon emanating from uranium-rich building materials (e.g. concrete blocks or gypsum wallboard); this is not known to be a problem in Pennsylvania.

FIGURE 4.3.7-1 SKETCH OF RADON ENTRY POINTS INTO A HOUSE (ARIZONA GEOLOGICAL SURVEY, 2006).



High radon levels were initially thought to be exacerbated in houses that are tightly sealed, but it is now recognized that rates of air flow into and out of houses, plus the location of air inflow and the radon content of air in the surrounding soil, are key factors in radon concentrations. Outflows of air from a house, caused by a furnace, fan, thermal "chimney" effect, or wind effects, require that air be drawn into the house to compensate. If the upper part of the house is tight enough to impede influx of outdoor air (radon concentration

generally <0.1 pCi/L), then an appreciable fraction of the air may be drawn in from the soil or fractured bedrock through the foundation and slab beneath the house, or through cracks and openings for pipes, sumps, and similar features (see Figure 4.3.7-1). Soil gas typically contains from a few hundred to a few thousand pCi/L of radon; therefore, even a small rate of soil gas inflow can lead to elevated radon concentrations in a house.

The radon concentration of soil gas depends upon a number of soil properties, the importance of which is still being evaluated. In general, ten to fifty percent of newly formed radon atoms escape the host mineral of their parent radium and gain access to the air-filled pore space. The radon content of soil gas clearly tends to be higher in soils containing higher levels of radium and uranium, especially if the radium occupies a site on or near the surface of a grain from which the radon can easily escape. The amount of pore space in the soil and its permeability for air flow, including cracks and channels, are important factors determining radon concentration in soil gas and its rate of flow into a house. Soil depth and moisture content, mineral host and form for radium, and other soil properties may also be important. For houses built on bedrock fractured zones may supply air having radon concentrations similar to those in deep soil.

Each county in Pennsylvania is classified as having a *low*, *moderate*, or *high* radon hazard potential. Carbon County is classified as having a high hazard, meaning there is a predicted indoor radon level greater than 4 pCi/L (see Figure 4.3.7-2).

Areas where houses have high levels of radon can be divided into three groups in terms of uranium content in rock and soil:

- Areas of very elevated uranium content (>50 ppm) around uranium deposits and prospects. Although very high levels of radon can occur in such areas, the hazard normally is restricted to within a few hundred feet of the deposit. In Pennsylvania, such localities occupy an insignificant area.
- Areas of common rocks having higher than average uranium content (5 to 50 ppm). In Pennsylvania, such rock types include granitic and felsic alkali igneous rocks and black shales. In the Reading Prong, high uranium values in rock or soil and high radon levels in houses are associated with Precambrian granitic gneisses commonly containing 10 to 20 ppm uranium, but locally containing more than 500 ppm uranium. In Pennsylvania, elevated uranium occurs in black shales of the Devonian Marcellus Formation and possibly the Ordovician Martinsburg Formation. High radon values are locally present in areas underlain by these formations.

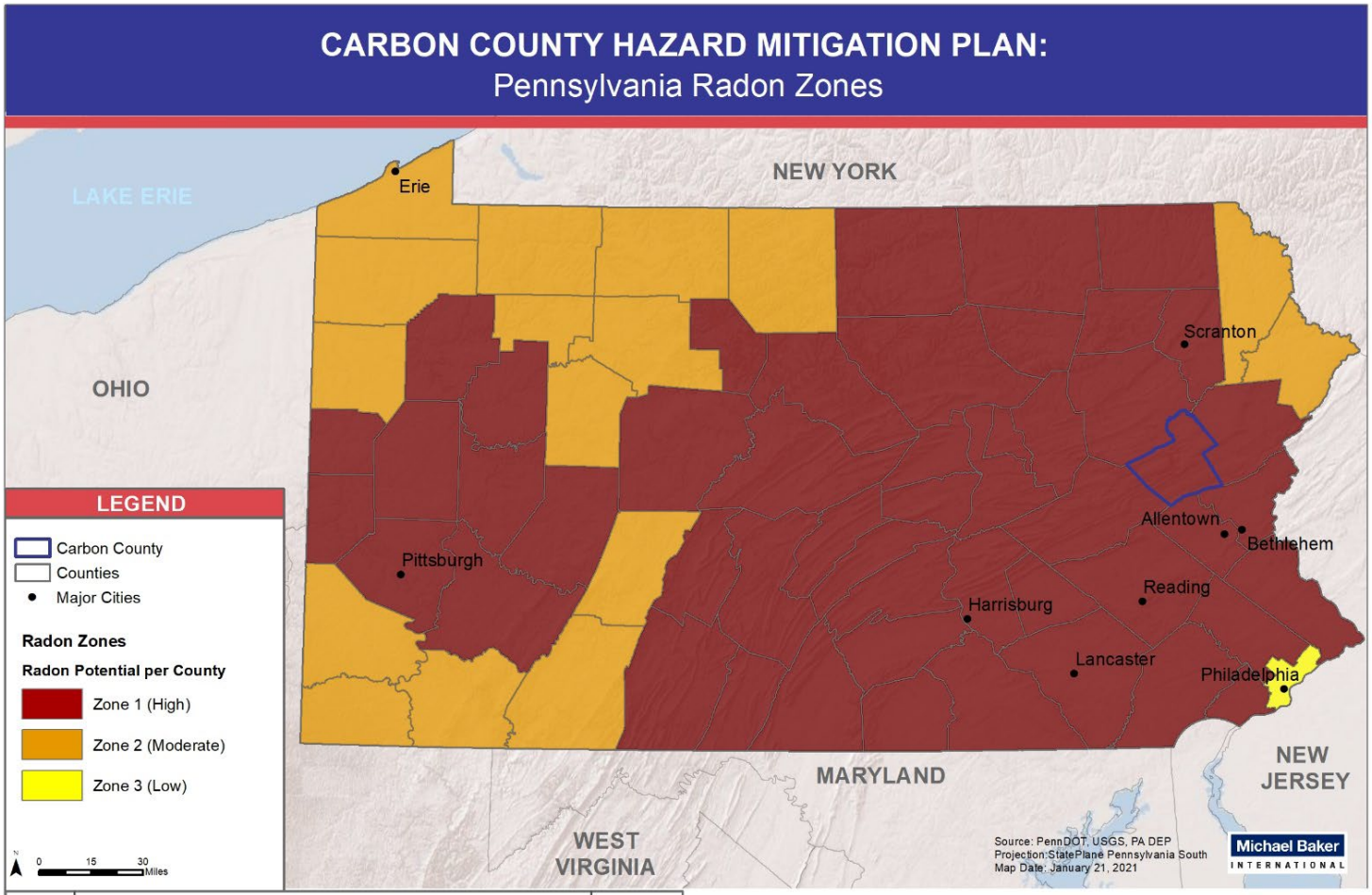
Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses. This group is incompletely understood at present. Relatively high soil permeability can lead to high radon, the clearest example being houses built on glacial eskers. Limestone-dolomite soils also appear to be predisposed for high radon levels in houses, perhaps because of the deep clay-rich residuum in which radium is concentrated by weathering on iron oxide or clay surfaces, coupled with moderate porosity and permeability.

Figures 4.3.7-2 and 4.3.7-3show the radon test data available for Carbon County by zip code. Most communities have average basement radon readings of over the threshold of action of 4 pCi/L. Communities with no data available did not have a sufficient sample size.

The highest recorded basement radon readings in Carbon County were 1,013.0 pCi/L in Jim Thorpe, 718.7 in Slatington, 394.8 in Kunkletown, and 382.9 in Walnutport. First floor average radon levels were substantially lower than average test results for basements, but many

communities still exceeded the 4pCi/L threshold, which is shown in Figure 4.3.7-4. Additionally, maximum first floor radon levels were much lower than those for basements, but all exceeded the threshold of action

FIGURE 4.3.7-1 RADON HAZARD ZONES IN PENNSYLVANIA, 2014



	Zone 1 counties have a predicted average indoor radon screening level greater that 4 pCi/L (pico curies per liter) **(red zones)**	**High** Potential
	Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L **(orange zones)**	**Moderate** Potential
	Zone 3 counties have a predicted average indoor radon screening less than 2 pCi/L **(yellow zones)**	**Low** Potential

FIGURE 4.3.7-2 CARBON COUNTY AVERAGE BASEMENT RADON TEST RESULTS

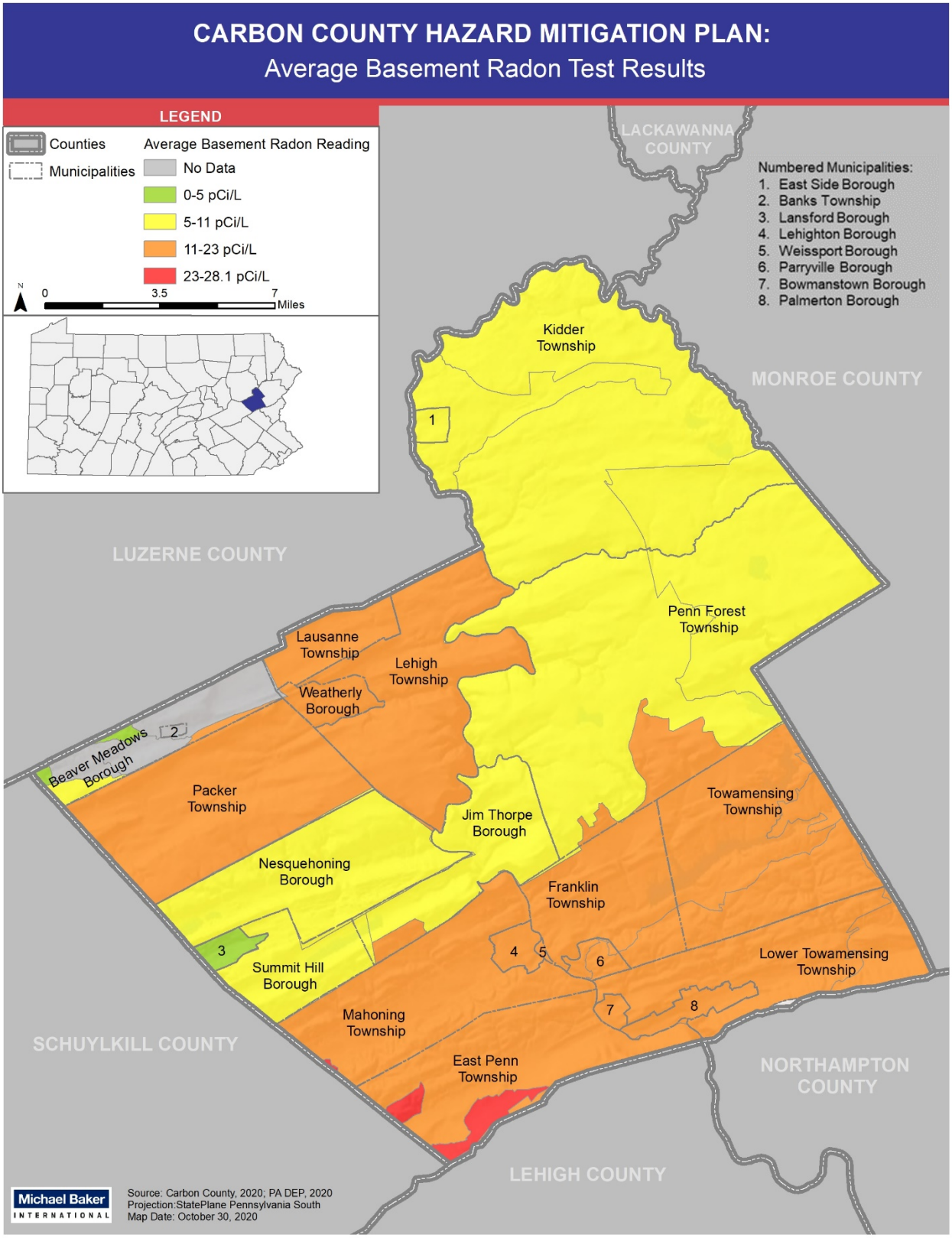
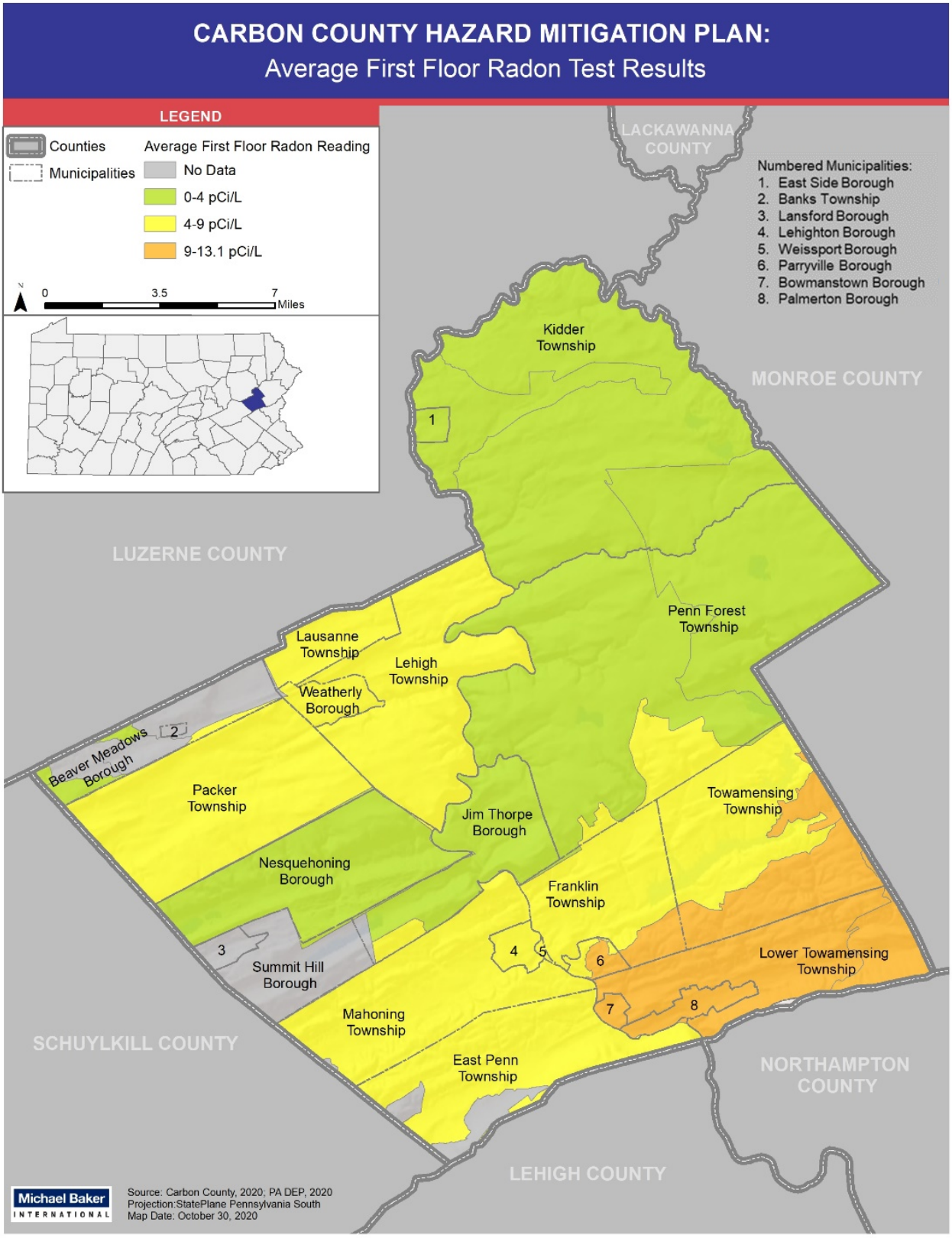


FIGURE 4.3.7-3 CARBON COUNTY AVERAGE FIRST FLOOR RADON TEST RESULTS



4.3.7.2. Range of Magnitude

Exposure to radon is the second leading cause of lung cancer after smoking. It is the number one cause of lung cancer among non-smokers. Radon is responsible for about 21,000 lung cancer deaths every year; approximately 2,900 of which occur among people who have never smoked. Lung cancer is the only known effect on human health from exposure to radon in air and thus far, there is no evidence that children are at greater risk of lung cancer than are adults (EPA, March 2010). The main hazard is actually from the radon daughter products (218Po, 214Pb, 214Bi), which may become attached to lung tissue and induce lung cancer by their radioactive decay.

According to the EPA, the average radon concentration in the indoor air of homes nationwide is about 1.3 pCi/L. The EPA recommends homes be fixed if the radon level is 4 pCi/L or more. However, because there is no known safe level of exposure to radon, the EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L. Table 4.3.7-1 shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As is shown in Table 4.3.7-1, a smoker exposed to radon has a much higher risk of lung cancer.

TABLE 4.3.7-1 RADON RISK FOR SMOKERS AND NON-SMOKERS (EPA, 2016).

RADON LEVEL (pCi/L)	IF 1,000 PEOPLE WERE EXPOSED TO THIS LEVEL OVER A LIFETIME*	RISK OF CANCER FROM RADON EXPOSURE COMPARES TO**	ACTION THRESHOLD
SMOKERS			
20	About 260 people could get lung cancer	250 times the risk of drowning	Fix Structure
10	About 150 people could get lung cancer	200 times the risk of dying in a home fire	
8	About 120 people could get lung cancer	30 times the risk of dying in a fall	
4	About 62 people could get lung cancer	5 times the risk of dying in a car crash	
2	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L

RADON LEVEL (pCi/L)	IF 1,000 PEOPLE WERE EXPOSED TO THIS LEVEL OVER A LIFETIME*	RISK OF CANCER FROM RADON EXPOSURE COMPARES TO**	ACTION THRESHOLD
1.3	About 2 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	-	(Average outdoor radon level)	
NOTE: Risk may be lower for former smokers. ** Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).* *** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.*			

The worst-case scenario for radon exposure would be that a large area of tightly sealed homes provided residents high levels of exposure over a prolonged period of time without the resident being aware. This worst-case scenario exposure then could lead to a large number of people with cancer attributed to the radon exposure.

4.3.7.3. Past Occurrence

Current data on abundance and distribution of radon as it affects individual houses in the state of Pennsylvania in general is considered incomplete and potentially biased. Carbon County is not an exception. The EPA has estimated that the national average indoor radon concentration is 1.3 pCi/L and the level for action is 4.0 pCi/L; however they have estimated that the average indoor concentration in Pennsylvania basements is about 7.1 pCi/L and 3.6 pCi/L on the first floor (PADEP, 2019).

The Pennsylvania Department of Environmental Protection Bureau of Radiation Protection provides information for homeowners on how to test for radon in their houses. If a test results in radon concentrations over 4 pCi/L, then the Bureau works to help the homeowners make repairs to their houses to mitigate against high radon levels. The total number tests reported to the Bureau since 1990 and their results are provided by zip code on the Bureau's website. However, this information is only provided if over 30 tests total were reported in order to best approximate the average for the area.

In Carbon County, 22 zip codes had sufficient tests reported to the Bureau to list their findings, which are shown in Table 4.5.7-2. This table does not include the ZIP codes for which insufficient data was collected in both basements and first floors. The spatial distribution of this data across all ZIP codes is illustrated in Figures 4.3.7-2 and 4.3.7-3.

TABLE 4.3.7-2 RADON LEVEL TESTS AND RESULTS IN CARBON COUNTY ZIP CODES (PA DEP, 2021C).

Zip Code	Community	Basement			First Floor		
		Number of Tests	Maximum Result (pCi/L)	Average Result (pCi/L)	Number of Tests	Maximum Result (pCi/L)	Average Result (pCi/L)
18038	Danielsville	303	281.8	18.7	42	67.6	8.7
18053	Germansville	269	301.7	28.1	Insufficient Data		
18058	Kunkletown	888	394.8	17.0	132	152.8	11.2
18071	Palmerton	639	330.6	16.5	72	165.8	10.1
18080	Slatington	1229	718.7	18.9	182	107.6	8.0
18088	Walnutport	923	382.9	17.5	103	70.3	9.8
18201	Hazleton	1407	63.5	3.6	269	10.2	1.2
18210	Albrightsville	854	163.5	7.1	379	21.2	2.2
18211	Andreas	112	321.8	25.4	Insufficient Data		
18224	Freeland	303	103.0	6.2	74	20.8	2.3
18229	Jim Thorpe	968	1013.0	10.4	188	44.6	3.5
18232	Lansford	92	24.5	3.7	Insufficient Data		
18235	Lehighton	1435	362.6	17.2	175	115.3	8.4
18237	McAdoo	199	38.4	5.7	58	19.7	2.3
18240	Nesquehoning	221	178.0	5.6	34	8.0	1.7
18250	Summit Hill	133	76.8	5.5	Insufficient Data		
18252	Tamaqua	560	162.9	12.2	83	47.6	5.3
18255	Weatherly	474	97.0	13.3	82	85.0	5.9
18333	Kresgeville	204	201.2	16.9	30	54.7	13.1
18610	Blakeslee	556	353.7	7.6	231	22.7	2.3
18624	Lake Harmony	242	143.0	5.2	169	15.6	2.5
18661	White Haven	530	94.2	5.5	139	48.7	2.8

4.3.7.4. Future Occurrence

Radon exposure retains a significant probability given present soil, geologic, and geomorphic factors in Carbon County. Future occurrence of high radon level hazards can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

Development in areas where previous radon levels have been significantly high will continue to be more susceptible to exposure. However, new incidents of concentrated exposure may occur with future development or deterioration of older structures. Exposure can be limited with proper testing for both past and future development and appropriate mitigation measures.

4.3.7.5. Vulnerability Assessment

Structures in Carbon County, particularly in high vulnerability areas as shown in Figures 4.3.7-2 and 4.3.7-3, could be susceptible to moderate levels of radon. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to (see Table 4.3.7-1). Older houses that have crawl spaces or unfinished basements are more vulnerable as well because of the increased exposure to soils which

could be releasing higher levels of radon gas. Additionally, houses that rely on wells for their water may face an additional risk, although this type of exposure is low and rare in Pennsylvania.

Proper testing for radon levels should be completed across Carbon County, especially in the areas of higher incidence levels and for vulnerable populations that face the contributing risks described above. This testing will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools. The Pennsylvania Department of Environmental Protection Bureau of Radiation Protection provides short- and long-term tests to determine radon levels as well as information on how to mitigate high levels of radon in a building.

The EPA determines that an average radon mitigation system costs $1,200. The EPA also states that current state surveys show that one home in five has elevated radon levels. Using this methodology, radon loss estimation is factored by assuming that 20 percent of the buildings within the zip codes with elevated test results have elevated radon values and each would require a radon mitigation system installed at the EPA estimated average of $1,200. According to the Pennsylvania State Hazard Mitigation Plan, Carbon County has 31,143 building in areas with high radon test results, while approximately 20 percent, or 6,229, of these buildings will be impacted. The estimated costs for radon mitigation total $7,474,320. As seen in Figures 4.3.7-3 and 4.3.7-4, areas with the highest reported tests were primarily located in the southern portions of the County.

Radon exposure has minimal environmental impacts. Due to the relatively short half-life of radon, it tends to only affect living and breathing organisms such as humans or pets which are routinely in contained areas (i.e. basement or house) where the gas is released.

4.3.8. Wildfire

4.3.8.1. Location and Extent

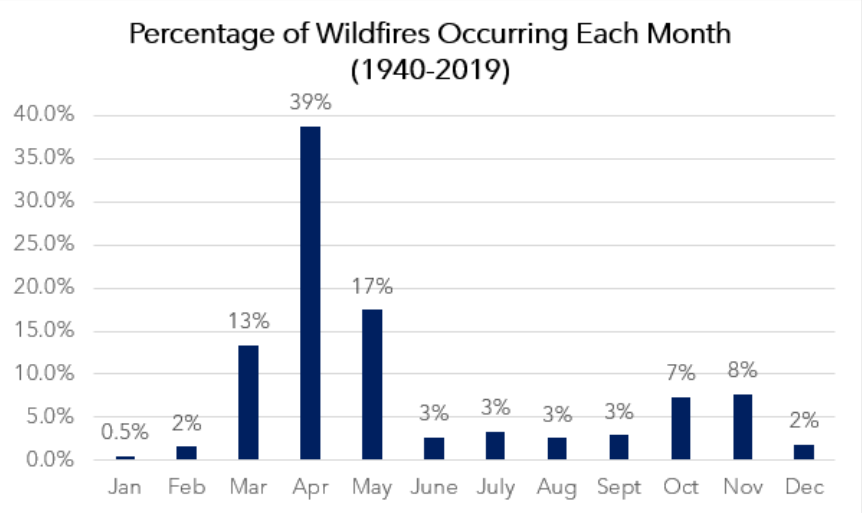
A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possible consuming structures. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. An urban-wildland interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

Wildfires can occur at any time of the year but are most likely to occur in the County during a drought. Wildland fires in Pennsylvania can occur in open fields, grass, dense brush, and forests. Under dry conditions or drought, wildfires have the potential to burn forests as well as cropland. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness, negligence, and ignorance. Over 90% of wildfires are caused by people. In 2019, debris burning accounted for the largest number of wildfires, while incendiary causes accounted for the largest number of acres burned in Pennsylvania (DCNR, 2019a). However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion.

More than 70 percent of Carbon County is covered by either Northern Hardwood or Mixed Oak forests (see Figure 2.4.1-2 for land cover illustration) (Carbon County, 2005). State Game Lands and State Park Lands make up over 2/3 of the County's total land area (CCED ,2021). These conditions make the potential geographic extent of wildfires quite large. Several fires

have started in a private backyard and traveled through dead grasses and weeds into bordering woodlands. Under dry conditions or droughts, wildfires have the potential to burn forests as well as croplands. The greatest potential for wildfires is in the spring months of March, April, and May, and, to a lesser extent, the autumn months of October and November. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris. In the fall, dried leaves are also fuel for fires. The percentage of wildfires occurring each month in Pennsylvania between 1940 and 2019 is shown in Figure 4.3.8-1. This pattern is consistent with wildfires in Carbon County.

FIGURE 4.3.8-1 PERCENTAGE OF WILDFIRES OCCURRING EACH MONTH (PA DCNR, 2019B).



4.3.8.2. Range of Magnitude

Wildfire events can range from small fires that can be managed by local firefighters to large fires impacting many acres of land. Large events may require evacuation from one or more communities and necessitate regional or national firefighting support. The impact of a severe wildfire can be devastating. A wildfire has the potential to kill people, livestock, fish, and wildlife. They often destroy property, valuable timber, and forage, recreational, and scenic values. Potential aftermath of wildfires includes severe erosion, silting of stream beds and reservoirs, and flooding due to a loss of ground cover. The most high-risk areas of the County are at the forest-urban interface, where the potential for wildfire to spread to structures is greatest.

Vegetation loss is often an environmental concern with wildfires, but it typically is not a serious impact in that they burn dead trees, leaves, and grasses to allow more open space for new and different types of vegetation to grow and receive sunlight. Another positive effect of a wildfire is that it stimulates the growth of new shoots on trees and shrubs and its heat can open pinecones and other seed pods. The most significant negative environmental impact is the potential for severe erosion, silting of stream beds and reservoirs, and flooding due to ground-cover loss following a fire event. Approximately 73% of Carbon County consists of forested areas, in many cases surrounded by cropland and pastures (see Figure 2.4.1-1). In Pennsylvania, 98 percent of wildfires are caused by people, often by debris burns (DCNR, 2019a).

In addition to the risk wildfires pose to the general public, property owners, and the environment, the safety of firefighters is also a concern. Although loss of life among firefighters does not occur often in Pennsylvania, it is always a risk. More common firefighting injuries include falls, sprains, abrasions, or heat-related injuries such as dehydration. Response to wildfires also exposes emergency responders to the risk of motor vehicle accidents and can place them in remote areas away from the communities that they are chartered to protect.

The worst-case scenario for wildfires in Carbon County occurred in April 2015 when a wildfire in East Penn Township, named 'The Razor,' destroyed over 800 acres of land (see Figure 4.3.8-2). The rate of spread was extremely fast, averaging one acre every three minutes. Over 45 different fire departments from five counties responded to the fire.

4.3.8.3. Past Occurrence

Anecdotal accounts indicate that Carbon County has had a long history of wildfires. From the 1860s until the 1960s, many acres of the County burned yearly. The cause of these wildfires was usually either the engine sparks or overheated breaks of railroads (Carbon County, 1998).

FIGURE 4.3.8-2 NEWSPAPER CLIPPING DETAILING THE "RAZOR" WILDFIRE IN EAST PENN TOWNSHIP, APRIL 2015 (DCNR-BOF, 2015B)


LEHIGH, MONROE & NORTHAMPTON COUNTIES

See Page 5

ON THIS DATE

April 25, 1974

A sharp exchange of words between county Commissioner Charles R. Wildoner and county Controller Allen D. Kistler took place at the Carbon County Salary Board meeting when an argument between the board and Kistler occurred.

The emotional exchange resulted from a proposal by the commissioners to eliminate the position of statistician in the controller's office.

Commissioner Albert D. Koch said the reason for the proposal was that the controller informed the commissioners his office will not check the tax collectors' reports, a practice Koch said was in place for a long period of time.

After the exchange, the salary board tabled action on elimination of the position.

WILLIAM G. SCHWAB & ASSOCIATES Attorneys At Law uslawcenter.com

TODAY'S THOUGHT

"It's the friends you can call up at 4 a.m. that matter."

– Marlene Dietrich, German-American

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Smoke from the brush fire on the Blue Mountain last weekend could be seen for miles. More than 800 acres burned.

WORST-CASE SCENARIO

30-hour brush fire shows how quickly

576 wildfire events were reported to the Pennsylvania Department of Conservation and Natural Resources–Bureau of Forestry (DCNR-BOF) between 2002 and 2020 as show in Table 4.3.8-1 below. The largest number of fires was experienced in 2008; the 64 fires resulted in 54 acres burned. As shown in Table 4.3.8-2, the largest number of acres burned occurred in 2015, with over 1,560 acres burned. A complete list of wildfire events and acres burned is located in Appendix I. While this list does not include wildfires that were not reported to DCNR or that were controlled solely by the volunteer fire departments in the County, this is the most comprehensive list of wildfire occurrences available for Carbon County.

TABLE 4.3.8-1 CARBON COUNTY WILDFIRE SUMMARY FROM 2002-2020 (DCNR BOF, 2020).

YEAR	NUMBER OF FIRES	ACRES BURNED
2002	36	25.2
2003	17	18.6
2004	19	6.4
2005	52	50.5
2006	52	318.4
2007	36	59.5
2008	64	54.0
2009	25	107.3

2010	32	9.9
2011	11	3.3
2012	32	46.3
2013	25	18.2
2014	18	12.7
2015	29	1560.6
2016	30	14.0
2017	14	4.0
2018	11	53.3
2019	21	11.2
2020	52	324.8
TOTAL	576	2698.1

Table 4.3.8-2 summarizes past occurrence data at the municipal level from 2002 to 2020. East Penn, Kidder, and Lehigh Townships have experienced the largest number of acres burned as a result of wildfires.

Two fires not noted in the data set above have occurred in Carbon County in 2015. The two largest wildfires that have occurred in the Commonwealth that year, named Razor and Pipeline 1, were located in Carbon County. The Razor wildfire, pictured in figure 4.3.8-3 and 4.3.8-4, occurred in April 2015 and affected around 850 acres on Blue Mountain.

TABLE 4.3.8-2 ACRES BURNED BY WILDFIRES IN EACH MUNICIPALITY FROM 2002-2020 (DCNR BOF, 2020).

YEAR	BANKS TOWNSHIP	BEAVER MEADOWS BOROUGH	BOWMANSTOWN BOROUGH	EAST PENN TOWNSHIP	EAST SIDE BOROUGH	FRANKLIN TOWNSHIP	JIM THORPE BOROUGH	KIDDER TOWNSHIP	LANSFORD BOROUGH	LAUSANNE TOWNSHIP	LEHIGH TOWNSHIP	LEHIGHTON BOROUGH	LOWER TOWAMENSING TOWNSHIP	MAHONING TOWNSHIP	NESQUEHONING BOROUGH	PACKER TOWNSHIP	PALMERTON BOROUGH	PARRYVILLE BOROUGH	PENN FOREST TOWNSHIP	SUMMIT HILL BOROUGH	TOWAMENSING TOWNSHIP	WEATHERLY BOROUGH	WEISSPORT BOROUGH	YEARLY TOTAL
2002	-	-	-	1.3	-	0.1	2.5	2.1	-	-	0.5	-	4.0	4.1	0.2	6	0.1	-	3.7	0.5	-	0.3	-	25.2
2003	0.2	0.1	-	0.3	-	1.5	-	-	-	-	-	-	6.2	5.0	-	0.8	0.1	-	2.4	-	2.1	-	-	18.6
2004	-	-	-	-	-	0.1	0.7	1.9	-	0.3	-	0.1	2.4	-	0.2	-	0.1	-	0.2	-	0.5	-	-	6.4
2005	1.5	-	-	0.9	-	1.4	1	0.7	-	7.3	0.8	0.2	1.2	0.9	29.1	1	0.1	-	1.3	1	2.2	0.1	0.1	50.5
2006	0.13	-	1.8	0.2	-	0.5	18.8	0.5	-	0.5	260.0	0.4	1.6	17.5	4.6	4.4	0.1	-	1.5	2.2	3.5	0.1	-	318.4
2007	-	-	-	0.5	-	1.0	32.6	0.7	0.3	-	12.0	-	0.5	1.0	0.5	0.4	-	-	1.3	6.5	2.3	-	-	59.5
2008	1.6	-	-	2.0	-	1.9	1.5	1.7	0.1	0.5	8.6	-	26.5	1	0.5	0.9	-	0.5	3.3	0.3	2.9	0.5	-	54.0
2009	1.3	-	75.0	1.8	-	1.5	0.8	-	1.8	-	0.5	-	2.6	0.3	-	0.1	-	4.9	15.6	1.3	0.1	-	-	107.31
2010	1.4	-	0.5	0.3	-	1.5	0.2	0.7	0.3	-	1.6	-	0.6	0.5	0.3	-	-	0.3	0.6	-	1.3	-	-	9.9
2011	0.5	-	0.4	-	-	-	0.6	-	-	0.5	-	-	0.3	-	-	-	-	-	0.6	-	0.5	-	-	3.3
2012	15.0	-	-	0.5	0.5	3.3	0.3	7.5	-	-	-	-	2.7	0.5	0.1	-	0.3	0.1	0.4	0.4	15	-	-	46.3
2013	2.5	-	-	2.1	-	0.5	-	1.8	-	1.0	-	-	6.0	0.7	1.3	-	1.5	-	0.5	-	0.4	-	0.1	18.2
2014	-	-	0.4		-	3.5	-	2.1	-	-	0.1	-	0.6	0.1	0.8	1	-	-	3.7	-	0.5	-	-	12.7
2015	0.3	-	-	848.25	-	5.4	0.2	676.0	-	-	23.5	0.3	1.5	0.8	0.3	-	0.1	-	0.7	2.5	1	-	-	1560.6
2016	-	-	0.1	4	-	0.3	-	-	-	-	0.2	0.4	1.9	2.5	0.5	-	0.3	-	1.2	-	2.8	-	-	14.0
2017	-	-	-	0.1	-	0.3	-	0.2	0.25	-	0.1	-	0.1	-	-	-	0.8	-	1.2	1.0	-	-	-	4.0
2018	-	-	-	0.8	-		1.1	-	-	-	-	-	51.1	-	0.3	-	0.1	-	-	-	-	-	-	53.3
2019	-	-	-	0.3	-	0.4	-	0.2	-	-	-	-	5.6	1.3	-	-	0.1	0.1	0.5	-	2.8	-	-	11.2
2020	0.3	-	-	3.9	-	1.7	0.6	-	0.4	2.0	308.1	-	1.8	2.0	0.1	0.7	-	-	0.9	1.8	0.7	0.1	-	324.84
MUNICIPAL TOTAL	24.6	0.1	78.1	866.9	0.5	24.6	60.7	696.0	3.0	12.0	615.9	1.3	116.9	38.0	38.7	15.2	3.6	5.8	39.3	17.3	38.5	1.1	0.2	2698.1

FIGURE 4.3.8-3 IMAGE OF "RAZOR" WILDFIRE IN EAST PENN TOWNSHIP, APRIL 2015. (DCNR-BOF, 2015B)

FIGURE 4.3.8-4 IMAGE OF "RAZOR" WILDFIRE IN EAST PENN TOWNSHIP, APRIL 2015 (DCNR-BOF, 2015B)

Figure 4.3.8-5 shows the locations and sizes of wildfires reported to DCNR between 2008 and 2013. As illustrated in the map, previous occurrences of wildfires have occurred throughout the entire County. There appears to be a cluster of previous wildfire events in Bowmanstown Borough and Lower Towamensing Township. However, any area with forest or brush is vulnerable to wildfires.

FIGURE 4.3.8-5 MAP SHOWING LOCATION OF WILDFIRE EVENTS WITH KNOWN LOCATIONS REPORTED TO DCNR IN CARBON COUNTY FROM 2008-2013.

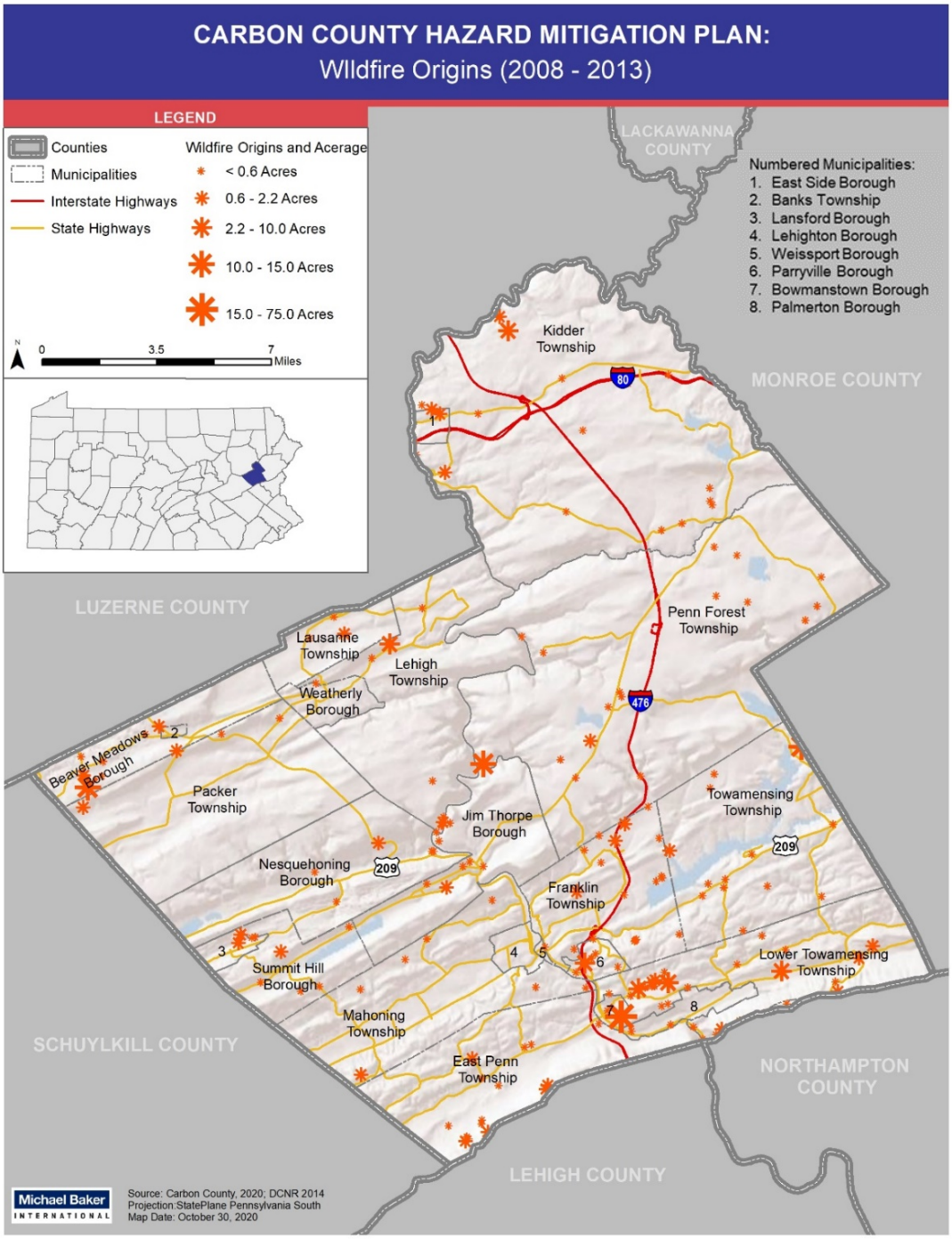


Table 4.3.8-3 below lists the number of calls recorded in each municipality by the Carbon County Communications Center in regard to wildfires from 2015 to 2020. The most calls were seen in dense municipalities including Lehighton Borough, Palmerton Borough, and Jim Thorpe Borough. All municipalities have significant tree coverage despite levels of density. It should be noted that the most vulnerable locations are at the urban/wildland interface, which may explain why there are so many occurrences in more developed communities. Eight events noted in the table were recorded near or on the turnpike; however, municipal locations are not provided. Carbon County was also called to respond to wildfire events in nearby counties. Eight addresses in Carbon County called in at least five wildfire events between 2015 and 2020; two of these had over ten calls. All of these addresses are located at the urban/wildland interface, and includes five farms, one restaurant, one highway, and one dam all of which are surrounded by wooded areas.

TABLE 4.3.8-3 WILDFIRE CALLS RECORDED BY THE CARBON COUNTY COMMUNICATIONS CENTER FROM 2015 TO 2020 (CARBON COUNTY, 2021B)

MUNICIPALITY	NUMBER OF WILDFIRES	MUNICIPALITY	NUMBER OF WILDFIRES
Albrightsville*	25	Lower Towamensing Township	15
Banks Township	4	Mahoning Township	6
Beaver Meadows Borough	7	Nesquehoning Borough	20
Blakeslee**	2	Packer Township	0
Bowmanstown Borough	12	Palmerton Borough	71
East Penn Township	7	Parryville Borough	5
East Side Borough	0	Penn Forest Township	5
Franklin Township	2	Summit Hill Borough	18
Jim Thorpe Borough	38	Towamensing Township	1
Kidder Township	19	Tresckow*	4
Kunkletown**	7	Walnutport Borough**	1
Lake Harmony*	25	Weatherly Borough	26
Lansford Borough	17	Weissport Borough	3
Lausanne Township	0	White Haven Borough**	5
Lehigh Township	0	TOTAL	501
Lehighton Borough	14		
*Unincorporated communities in Carbon County			
**Communities in Luzerne, Monroe, or Northampton Counties that Carbon County responded to.			

In May 2020, a wildland spread through the Lehigh Gorge State Park in Carbon County. Twenty fire departments and the state Bureau of Forestry were deployed to suppress the wildfire, which spanned over 315 acres for several days. The wildfire was caused by a

combination of direct sunlight on leaves, a little bit of wind, and relatively low humidity (Wojcik, 2020).

FIGURE 4.3.8-6 LEHIGH GORGE STATE PARK BRUSH FIRE (PHOTO CREDIT: TIMES NEWS, 2020)

DCNR-BOF no longer reports wildfires at the County or municipal level, but instead by State Forest District. Carbon County is located in two State Forest Districts, the majority being in Weiser (18) and a small portion falling into Delaware (19). Table 4.3.8-4 below lists the number of wildfires in these districts between 2014 and 2019. This data represents several counties in Eastern Pennsylvania, showing a regional view of past wildfire occurrences for Carbon County. In 2015 and 2016 the region experienced wildfires causing the majority of acres burned throughout the commonwealth, with 54.2% and 72.4% of acres burned respectively.

TABLE 4.3.8-4 LIST OF WILDFIRE EVENTS REPORTED FROM 2014-2019 BY STATE FOREST DISTRICT (DCNR-BOF, 2019A).

YEAR	DISTRICT 18		DISTRICT 19	
	# FIRES	ACRES BURNED	# FIRES	ACRES BURNED
2014	122	216.3	24	660.7
2015	128	2,070.70	41	186.8
2016	143	135.2	37	8,690
2017	75	344.6	12	143.1
2018	86	111.7	31	29.6
2019	73	51.3	22	12.5

4.3.8.4. Future Occurrence

Previous events indicate that wildfire events will continue to occur yearly. Weather conditions like drought can increase the likelihood of wildfires occurring. Many wildfires in the county are also the result of human-caused ignitions. Any fire, without the quick response or attention of fire-fighters, forestry personnel, or visitors to the forest, has the potential to become a wildfire. Therefore, the probability of a wildfire occurring in Carbon County can be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1). The likelihood of a wildfire attaining significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response.

4.3.8.5. Vulnerability Assessment

The Pennsylvania Bureau of Forestry has conducted an independent wildfire hazard risk assessment for the municipalities in Carbon County in 2010, which is the most recent

assessment of this type available. *Wildfire hazard* is defined based on conditions that affect wildfire ignition and/or behavior such as fuel, topography and local weather. Results of that assessment are shown in Figure 4.3.8-7. Based on this assessment, the majority of municipalities within Carbon County have a *high wildfire hazard potential*. Mahoning Borough, Palmerton Borough, Summit Hill Borough, and Weatherly Borough are considered to have *medium wildfire hazard potential*. Bank Township, Bowmanstown Borough, East Side Borough, Lansford Borough, Lehighton Borough, and Weissport Borough are considered to have *low wildfire hazard potential*.

Figure 2.4.1-2 in the Community Profile shows wooded areas throughout Carbon County. The County has significant tree coverage (73%), which is also particularly vulnerable to wildfire events. Many municipalities in the County have more than 90 percent forest coverage particularly in the northern portion of the County. Based on the concentration of forest coverage, Beaver Meadows Borough, Kidder Township, Lehigh Township, Packer Township, and Penn Forest Township are particularly vulnerable to wildfire hazard. More populated communities around Jim Thorpe Borough, Lehighton Borough, and Weissport Borough have less coverage but are still surrounded by a significant amount of forested land.

The vulnerability assessment for wildfires is based on the aforementioned wildfire hazard classification and the proximity to forest land use. For this assessment, all structures and critical facilities that are located within the jurisdictions identified by DCNR-Bureau of Forestry as being "High-Hazard" and in proximity to areas of forestland are considered most vulnerable to wildfire events.

Table 4.3.8-5 lists the total addressable structures and critical facilities (excluding oil and gas wells) in each municipality that are located in forested land use areas. Penn Forest has the highest number of structures in this vulnerable area with 3,101 structures, however, there are two municipalities with a higher percentage of their structures in vulnerable area: Lausanne and Lehigh Townships. Approximately 26 percent of all critical facilities are in the vulnerable area. Five municipalities have over 40 percent of their critical facilities in the vulnerable area: East Penn, Lausanne, Lehigh, Packer, and Penn Forest Townships. For a complete list of critical facilities and their vulnerability to wildfire hazards, please see Appendix E.

Table 4.3.8-6 lists the number of structures in wildfire hazard areas by land use type in each municipality. Residential land uses represent approximately 91% of structures in wildfire hazard areas. The next highest categories are commercial and unknown, which only represent about 3-4% of vulnerable structures.

FIGURE 4.3.8-7 WILDFIRE HAZARD POTENTIAL IN CARBON COUNTY.

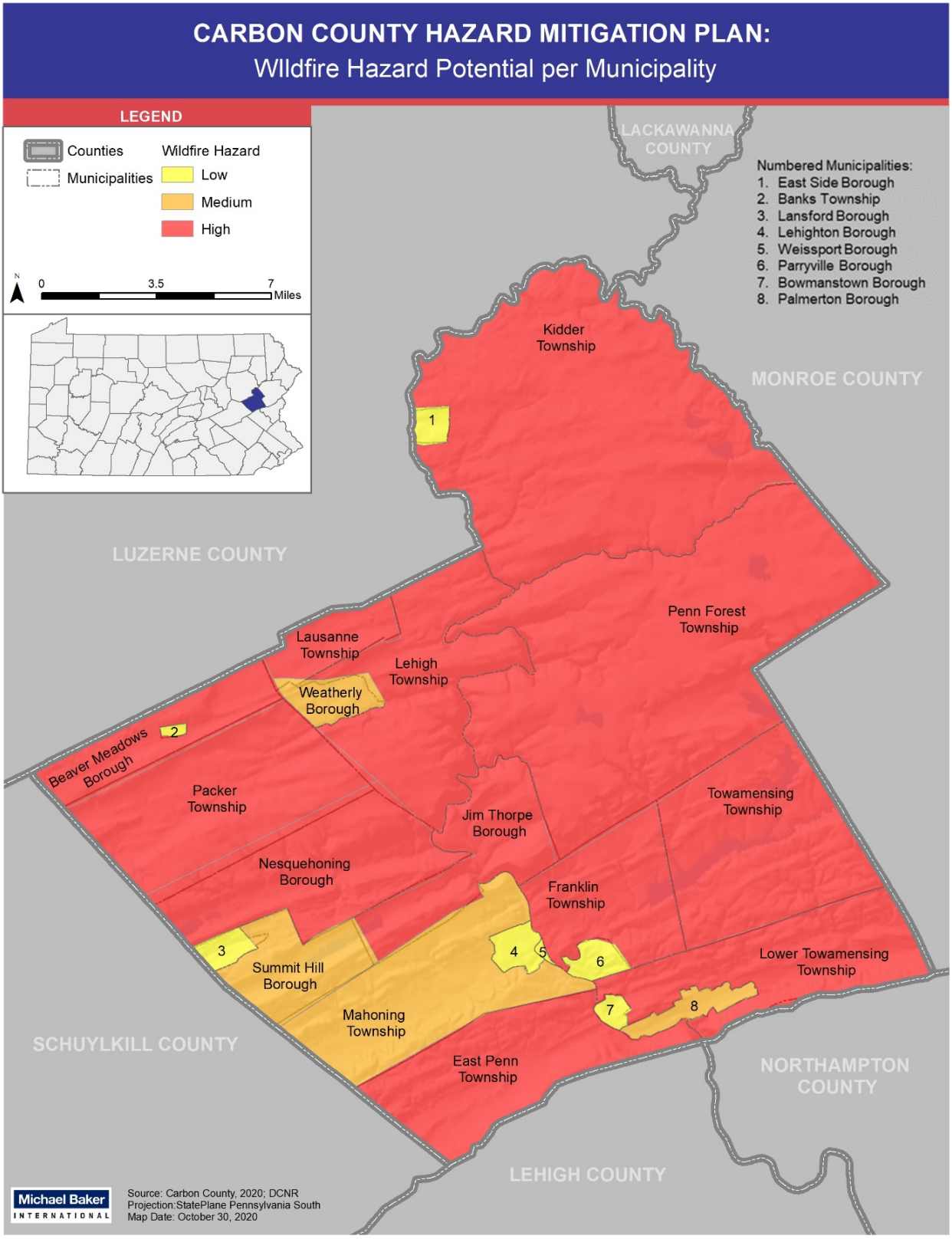


TABLE 4.3.8-5 NUMBER OF STRUCTURES AND CRITICAL FACILITIES IN PROXIMITY TO FORESTED LAND USE LOCATED WITHIN WILDFIRE HIGH-HAZARD AREA.

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN WILDFIRE HAZARD AREAS	PERCENT STRUCTURES IN WILDFIRE HAZARD AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN WILDFIRE HAZARD AREAS	PERCENT CRITICAL FACILITIES IN WILDFIRE HAZARD AREAS
Banks Township	655	59	9.0%	8	2	25.0%
Beaver Meadows Borough	441	4	0.9%	2	0	0%
Bowmanstown Borough	428	13	3.0%	4	0	0%
East Penn Township	1,552	436	28.1%	10	4	40.0%
East Side Borough	322	87	27.0%	1	0	0%
Franklin Township	2,207	626	28.4%	13	3	23.1%
Jim Thorpe Borough	2,473	420	17.0%	25	9	36.0%
Kidder Township	3,736	1032	27.6%	36	13	36.1%
Lansford Borough	2,096	18	0.9%	5	0	0%
Lausanne Township	132	67	50.8%	3	2	66.7%
Lehigh Township	289	138	47.8%	7	4	57.1%
Lehighton Borough	2,383	6	0.3%	12	0	0%
Lower Towamensing Township	1,540	312	20.3%	8	2	25.0%
Mahoning Township	1,989	471	23.7%	11	1	9.1%
Nesquehoning Borough	1,646	161	9.8%	17	4	23.5%
Packer Township	512	216	42.2%	5	3	60.0%
Palmerton Borough	2,328	25	1.1%	13	0	0%
Parryville Borough	311	60	19.3%	4	1	25.0%
Penn Forest Township	7,200	3101	43.1%	21	10	47.6%
Summit Hill Borough	1,496	113	7.6%	8	2	25.0%
Towamensing Township	1,980	805	40.7%	20	2	10.0%
Weatherly Borough	1,009	63	6.2%	7	0	0%
Weissport Borough	173	0	0%	3	0	0%
TOTAL	36,898	8,233	22.3%	243	62	25.5%

TABLE 4.3.8-6 WILDFIRE VULNERABILITY BY LAND USE

MUNICIPALITY	TOTAL STRUCTURES	CIVIC	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	UNKNOWN	UTILITY	TOTAL
Banks Township	655	2	1	0	49	7	0	59
Beaver Meadows Borough	441	0	0	0	4	0	0	4
Bowmanstown Borough	428	1	0	0	11	1	0	13
East Penn Township	1,552	4	3	0	418	11	0	436
East Side Borough	322	0	0	0	84	3	0	87
Franklin Township	2,207	10	47	0	548	21	0	626
Jim Thorpe Borough	2,473	11	13	0	327	69	0	420
Kidder Township	3,736	42	94	0	846	49	1	1,032
Lansford Borough	2,096	1	1	0	16	0	0	18
Lausanne Township	132	1	3	0	59	4	0	67
Lehigh Township	289	16	1	0	115	6	0	138
Lehighton Borough	2,383	0	0	0	6	0	0	6
Lower Towamensing Township	1,540	1	3	2	301	5	0	312
Mahoning Township	1,989	9	18	0	428	16	0	471
Nesquehoning Borough	1,646	4	9	0	143	3	2	161
Packer Township	512	9	3	1	192	11	0	216
Palmerton Borough	2,328	0	10	0	14	1	0	25
Parryville Borough	311	0	1	0	58	1	0	60
Penn Forest Township	7,200	25	18	0	2,971	87	0	3,101
Summit Hill Borough	1,496	3	2	0	104	4	0	113
Towamensing Township	1,980	8	5	0	763	29	0	805
Weatherly Borough	1,009	0	0	0	63	0	0	63
Weissport Borough	173	0	0	0	0	0	0	0
TOTAL	36,898	147	232	3	7,520	328	3	8,233

Headwaters Economics and the U.S. Forest Service have developed a series of profiles on wildfire risk across the country through the Community Planning Assistance for Wildfire program using data from Wildfire Risk to Communities. Profiles were developed for Carbon County as a whole and for Towamensing Trails in February 2021. Analyses identify a series of risk ranking for these two selected geographies:

Carbon County

- Populated areas in Carbon County have, on average, greater risk to structures than 74% of counties in Pennsylvania and 28% of counties nationwide.
- Populated areas in Carbon County have, on average, a greater wildfire likelihood than 77% of counties in Pennsylvania and 30% of counties nationwide.
- 50% of homes in Carbon County are exposed to wildfire from direct sources, such as adjacent flammable vegetation, compared to only 33% of homes nationwide.
    - The other 50% of homes in Carbon County are exposed to wildfire from indirect sources, such as embers or home-to-home ignition, compared to only 30% of homes nationwide.
- 8% of families in Carbon County are in poverty, compared to 10% of families nationwide.
- All households in Carbon County have access to at least one car, compared to 9% of households nationwide with no car access.

Towamensing Trails

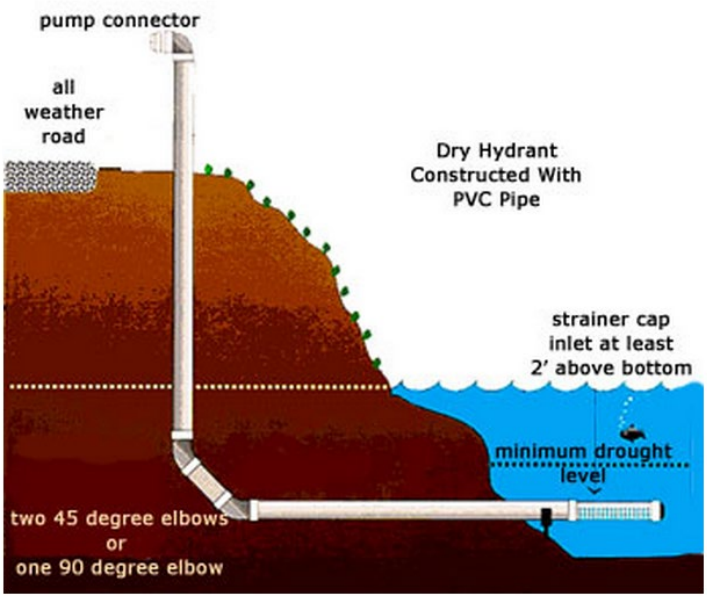
- Populated areas in Towamensing Trails have, on average, greater risk than 74% of communities in Pennsylvania and 32% of communities nationwide.
- Populated areas in Towamensing Trails have, on average, a greater wildfire likelihood than 81% of communities in Pennsylvania 37% of communities nationwide.
- 74% of homes in Towamensing Trails are exposed to wildfire from direct sources, such as adjacent flammable vegetation, compared to only 33% of homes nationwide.
    - The other 26% of homes in Towmanesing Trails are exposed to wildfire from indirect sources, such as embers or home-to-home-ignition, compared to 30% of homes nationwide.
- 6% of families in Towamensing Trails are in poverty, compared to 10% of families nationwide.
- All households in Towamensing Trails have access to at least one car, compared to 9% of households nationwide with no car access.

Risk to structures is analyzed through the integration of wildfire likelihood, the probability of wildfire occurring, and wildfire intensity, the energy released by a wildfire, with expected consequences to homes if a fire occurs. Wildfire likelihood is the annual probability of a wildfire occurring in a specific location. These reports note that wildfire likelihood is difficult to modify but can be reduced through fuel treatment projects and ignition-prevention efforts. People's susceptibility to wildfire is based on their ability to prepare for, respond to, and recover from a wildfire. Vulnerable populations, such as families in poverty or households with no car access, are more likely to be disproportionately affected by wildfire disasters as they

lack resources, experience cultural and institutional barriers, have limited mobility, and/or have compromised physical health (Headwaters Economics, 2021a; Headwater Economics, 2021b).

The CCEMA estimates that the numerous and ever-expanding private developments that are being built in heavily wooded areas, especially in Kidder and Penn Forest Townships, present a higher risk and vulnerability to residents and property. Fires that occur in these areas are especially hard to extinguish because there is no municipal water supply with which to fight fires in these outlying areas. Un-pressurized water sources, such as lakes; ponds; and streams; accessed via "dry hydrants" provide a viable alternative to firefighting in areas where there is no municipal water supply. Dry hydrants are permanent installations that allow firefighters to draft water from a nearby stream or lake (NFPA, 2015). During the 2015 HMP planning process, the HMSC stated that a dry hydrant was recently installed in Towamensing Township, which also benefits neighboring Franklin Township and Beltzville State Park. Additionally, the HMSC noted that if local municipal fire chiefs had the ability to declare burn bans if their geographic area is more susceptible at the time to wildfires than the rest of the county, that this may result in better prevention of future fires.

FIGURE 4.3.8-8 ILLUSTRATION OF DRY HYDRANT (MILLER GROVE VOLUNTEER FIRE DEPARTMENT)



As of 2021, Jim Thorpe Borough is the only active community participant in the Firewise Program. This program addresses the risk of homes in the wildland/urban interface to wildfire. It encourages building, landscape, and design standards that decrease the risk of ignition for homes in fire-prone areas.

4.3.9. Winter Storm

4.3.9.1. Location and Extent

Heavy snow or ice occurs throughout the Commonwealth of Pennsylvania. Every municipality in Carbon County is affected by these storms. In many cases, surrounding states and even the larger northeastern U.S. region are affected. Carbon County experiences all levels of winter storms from ice storms and freezing rain to heavy snow and blizzards.

There are slight variations in the average amount of snowfall that is seen throughout the County because of terrain differences. Generally, the average annual snowfall in the County increases from south to north (see Figure 4.3.9-1). From 1981-2010, annual snowfall in Carbon County averaged between 31 and 40 inches in the southern part of the county, and between 41 and 50 inches in the northern part of the county. This is a reduction in average annual snowfall from the previous thirty-year average annual snowfall observation where areas in the southern part of the county averaged between 40 and 50 inches and areas in the northern part of the county could reach up to 70 inches.

4.3.9.2. Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice, and sometimes strong winds. They begin as low-pressure systems that move through Pennsylvania either following the jet stream or developing as extra-tropical cyclonic weather systems over the Atlantic Ocean called nor'easters. The effects of these storms can sometimes last for weeks, bringing several inches or even feet of snow and ice and cold temperatures. Due to their regular occurrence, these storms are considered hazards only when they result in damage to specific structures or cause disruption to traffic, communications, electric power, or other utilities. The cost of removing snow, repairing damages, especially from ice storms, and the loss to businesses can have a negative economic impact for communities. Winter storms can generate other hazards such as infrastructure disruption (blocked roads and power outages), human-caused hazards (traffic accidents and trapped vehicles), and technological problems (communication system outages and overload). Winter storms can adversely affect roadways, utilities, business activities, and can cause loss of life, frostbite, or freezing.

Winter storms may include one or more of the following weather events:

- Heavy Snowstorm: Accumulations of four inches or more in a six-hour period, or six inches or more in a twelve-hour period.
- Sleet Storm: Sleet is formed when snow falling to the earth partially melts as it passes through a layer of warm air. The precipitation then passes through a cold layer of air and refreezes into solid pellets. Sleet causes surfaces to become slippery, posing hazards to pedestrians and motorists.
- Ice Storm: An ice storm occurs when rain freezes upon impact with the ground or other objects such as trees and power lines. Heavy accumulations of ice can bring down trees and utility poles, disrupting power and communication for days while crews make the necessary repairs. The icy conditions are also dangerous for pedestrians and vehicular traffic.
- Blizzard: According to the National Weather Service, a blizzard is a severe snowstorm that occurs when winds reach 35 mph or more. The blowing snow reduces visibility to less than one-quarter of a mile for at least three hours. Storms that meet these criteria are not frequent in Carbon County; however, storms that produce blizzard-like conditions are a common occurrence.
- Severe Blizzard: Wind velocity of 45 miles per hour, temperatures of 10° Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

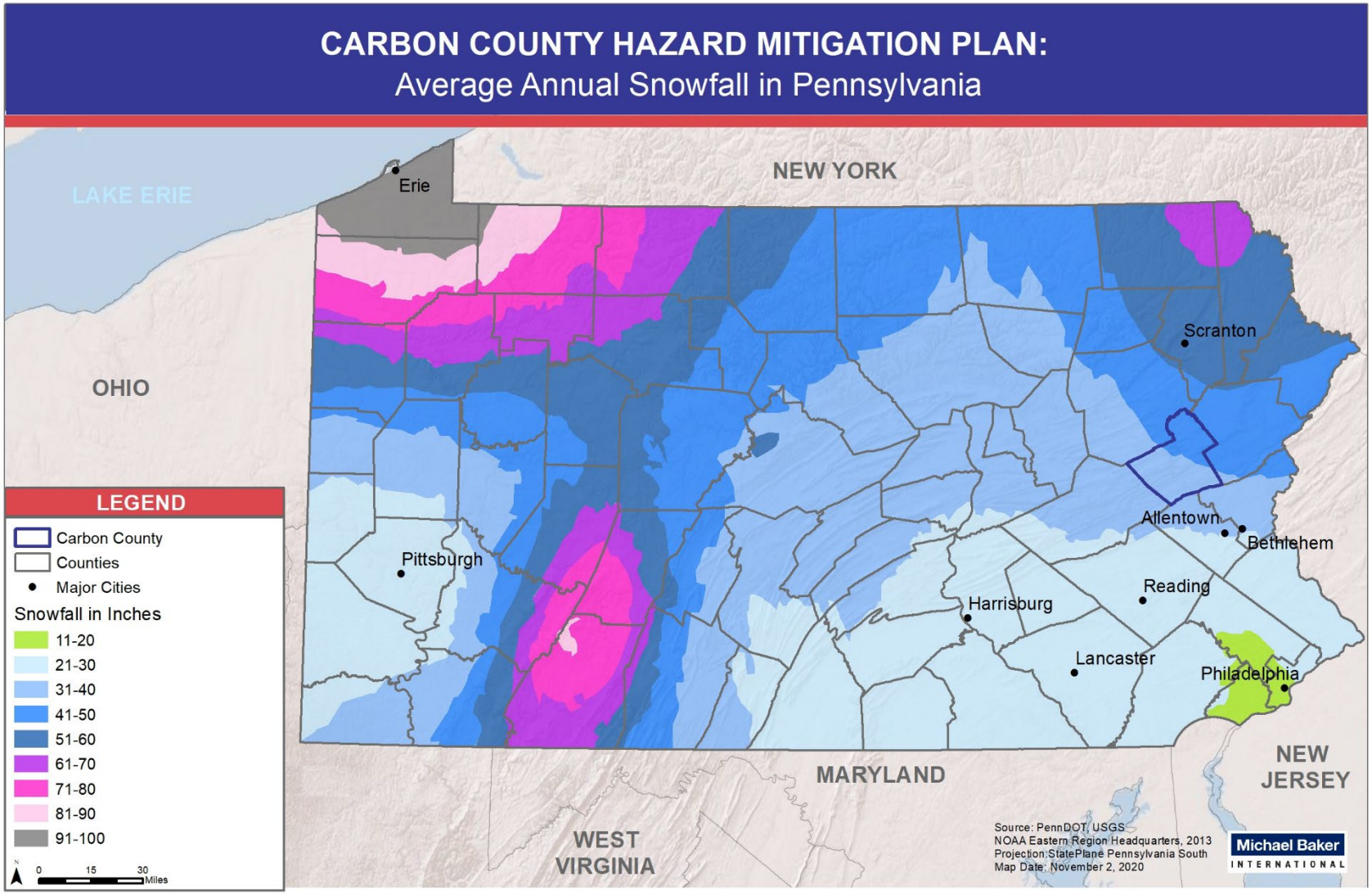
Any of the above events can result in the closing of major or secondary roads, particularly in rural locations, stranded motorists, transportation accidents, loss of utility services, and depletion of oil heating supplies. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds which can break limbs or even bring down large trees. Gradual melting of snow and ice provides excellent groundwater recharge. However, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

Five of the seventeen Presidential Disaster and Emergency Declarations affecting Carbon have been in response to hazard events related to winter storms (see Table 4.2-1). In addition to the events described above, other winter storm events, including those associated with Disaster Declarations, are listed in Appendix G.

The worst-case scenario of a winter storm in Carbon County occurred on January 5, 2005. A major winter storm hit Carbon County and a state of emergency was declared for Carbon and

Monroe Counties. Heavy ice build-up resulted in power outages and nearly three-quarters of the County was without power at one point. Downed trees prevented work crews and emergency responders from getting to certain areas for several days to a week (CCEMA, 2009). The storm resulted in $5 million of property damage. The County Emergency Operations Center was activated to coordinate shelters, essential travel, and evacuations.

FIGURE 4.3.9-1 MEAN ANNUAL SNOWFALL FOR PENNSYLVANIA AND CARBON COUNTY (NOAA –NWSFO).



4.3.9.3. Past Occurrence

Carbon County and the Commonwealth of Pennsylvania have a long history of severe winter weather. Between 1996 and 2020 there have been 439 winter storm events recorded by the NCDC. The county experienced 52 winter storm events in 2015; the most of any year in this period. Significant winter storm events that have affected Carbon County since 1996 are listed in Appendix G – Carbon County Winter Storms. Table 4.3.9-1 lists the number of winter storm events that have occurred in Carbon County each year between 11996 and 2020. The NCDC data on past occurrence for winter storm events since 1996 is the only comprehensive list of data available for the county aside from information from past disaster declarations. Many of the winter storms have been localized storms that have only affected Carbon County and Monroe County. This is due to the generally higher elevations and terrain of these two counties in the Pocono Mountain region of the Commonwealth. Prior to 1996, the County experienced significant winter storms in 1972, 1977, 1978, 1993, and 1996 (CCEMA, 2009).

TABLE 4.3.9-1 NUMBER OF WINTER STORM EVENTS IMPACTING CARBON COUNTY EACH YEAR FROM 1996-2020 (NCDC, 2021).

YEAR	NUMBER OF EVENTS	YEAR	NUMBER OF EVENTS
1996	9	2009	16
1997	15	2010	14
1998	11	2011	21
1999	10	2012	17
2000	12	2013	22
2001	16	2014	32
2002	17	2015	52
2003	18	2016	5
2004	19	2017	5
2005	23	2018	12
2006	13	2019	14
2007	29	2020	5
2008	32		

In the winter of 1993-1994, the commonwealth was hit by a series of protracted winter storms. The severity and nature of these storms combined with accompanying record-breaking frigid temperatures posed a major threat to the lives, safety, and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals and nursing homes. One of these devastating winter storms occurred in early January 1994 with record snowfall depths in many areas of the Commonwealth, strong winds, and sleet/freezing rains. Numerous storm-related power outages were reported and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed which closed major arterial roads and downed trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. Officials from PPL Corporation stated that this was the worst winter storm in the history of the company; related damage-repair costs exceeded $5,000,000.

Serious power supply shortages continued through mid-January because of record cold temperatures at many places, causing sporadic power generation outages across the

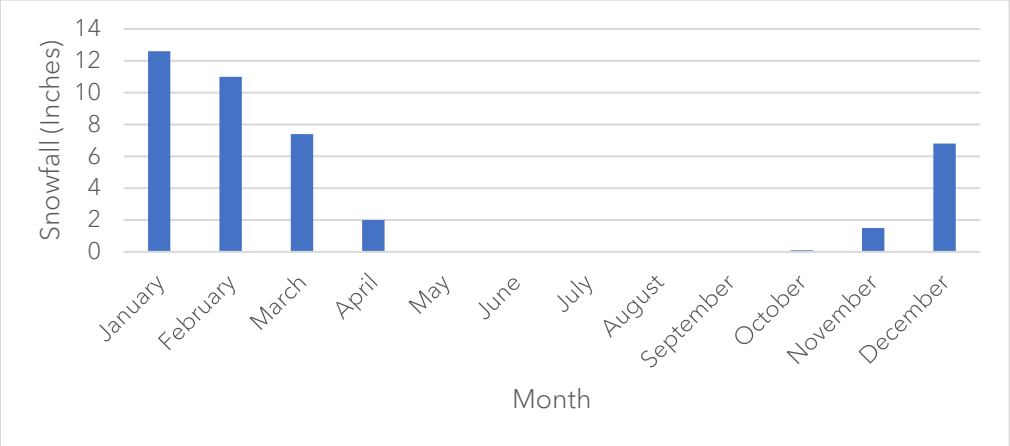
Commonwealth. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York and Virginia experienced 15-30 minute rolling blackouts, threatening the lives of people and the safety of buildings. Power and fuel shortages affecting Pennsylvania and the East Coast power grid system required the Governor to recommend power conservation measures be taken by all commercial, residential, and industrial power consumers. The record cold conditions resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. Additionally, the extreme cold in conjunction with accumulations of frozen precipitation resulted in acute shortages of road salt. As a result, trucks were dispatched to haul salt from New York to expedite deliveries to Pennsylvania Department of Transportation storage sites.

Storms in recent years have resulted in manageable weather conditions throughout the county. The most common conditions seen are snow and accumulation and cold temperatures which lead to pedestrian falls, stranded motorists, and vehicular accidents. Widespread power outages have not been reported since the 2015 HMP update.

4.3.9.4. Future Occurrence

Winter storms are a regular, annual occurrence in Carbon County and should be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1). Figure 4.3.9-2 shows the average measured snowfall at the weather station in Tamaqua from 1981-2010. As shown, the region experiences regular snowfall during winter months, particularly from December to March.

FIGURE 4.3.9-2 AVERAGE SNOWFALL BY MONTH AT TAMAQUA STATION (NOAA, 2021B).



4.3.9.5. Vulnerability Assessment

In Carbon County, accumulations of snow and/or ice during winter months are expected and normal. The most common detrimental effects of snow and/or ice are traffic accidents and interruptions in power supply and communications services.

Based on the information available, all communities in Carbon County are equally vulnerable to the direct impacts of winter storms. Residents of the mountainous areas of the County may be more susceptible, especially when emergency medical assistance is required. Further, some rural areas of the County are susceptible to isolation caused by winter storms including Lehigh, Lower Towamensing, Kidder, and Penn Forest Townships. Kidder and Penn Forest

Townships have heavily wooded private developments which make emergency response to the areas difficult when roadways are blocked by downed trees and wires (CCEMA, 2009). Emergency medical supplies, food, and fuel are sometimes required during these storms. Particular areas of vulnerability include low-income and elderly population, mobile homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to rapid snow melt.

Vulnerability to the effects of winter storms on buildings is somewhat dependent on the age of a building because as building codes become more stringent, buildings can support heavier loads and as buildings age, various factors may deteriorate their structural integrity. Vulnerability also depends upon the type of construction and the degree to which ha structure has been maintained.

Critical facilities would be impacted by a storm event, but these structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure.

The most vulnerable structures are those that were poorly built or are dilapidated. The weight of heavy snow or ice may lead to structural collapse or minor damage. Some shed roofs that protect township and borough road maintenance or firefighting equipment have large span roofs that may collapse under the weight of especially heavy snow or ice, although none have collapsed due to recent heavy snow or ice storms.

All structures and infrastructure in Carbon County are exposed to heavy snow and ice. For this analysis, structures built prior to 1940 are identified as being potentially at risk of being somewhat weakened and more susceptible to damage due to heavy snow or ice. The following table shows the number of housing units in Carbon County built prior to 1940 according to the ACS 2019 five-year estimates. Jim Thorpe, Lansford, Lehighton, and Palmerton Boroughs all have over 1,000 residential structures built prior to 1940 (1,547, 1,407, 1,220, and 1,125 respectively). Weissport, Jim Thorpe, and Lansford Boroughs have the largest proportions of housing units built prior to 1940 (76.7%, 67.3%, and 64.9% respectively). Overall, about 31% of housing units in the County were built prior to 1940 and represent the most vulnerable housing structures to winter storm hazards. While the U.S. Census Bureau provides estimates for residential structures, the age of non-residential structures in not available.

TABLE 4.3.9-2 HOUSING UNITS BUILT PRIOR TO 1940 IN CARBON COUNTY (U.S. CENSUS BUREAU, 2019).

Municipality	Number of Housing Units Built Prior to 1940	Percent of Total Housing Units
Banks Township	358	50.2%
Beaver Meadows Borough	234	56.3%
Bowmanstown Borough	202	43.5%
East Penn Township	173	12.8%
East Side Borough	47	30.7%
Franklin Township	391	19.7%
Jim Thorpe Borough	1,547	67.3%
Kidder Township	169	5.9%

Municipality	Number of Housing Units Built Prior to 1940	Percent of Total Housing Units
Lansford Borough	1,407	64.9%
Lausanne Township	19	18.3%
Lehigh Township	82	30.9%
Lehighton Borough	1,220	47.4%
Lower Towamensing Township	347	27.0%
Mahoning Township	622	32.8%
Nesquehoning Borough	782	49.9%
Packer Township	80	18.5%
Palmerton Borough	1,125	50.1%
Parryville Borough	168	53.7%
Penn Forest Township	175	2.5%
Summit Hill Borough	745	54.3%
Towamensing Township	222	11.4%
Weatherly Borough	550	50.1%
Weissport Borough	148	76.7%
TOTAL	10,813	31.1%

Because of the frequency of winter storms, strategies have been developed to respond to these events. Snow removal and utility repair equipment is available to respond to typical events. The use of auxiliary heat and electricity supplies such as wood burning stoves, kerosene heaters, and gasoline power generators reduces the vulnerability of humans to extreme cold temperatures commonly associated with winter storms. People residing in structures lacking adequate equipment to protect against cold temperatures or significant snow and ice are more vulnerable to winter storm events. As all structures and infrastructure in Carbon County will be exposed to heavy snow and ice, many municipalities in Carbon County have adopted the 2018 IBC and IRC building codes. New construction will be able to withstand the weight of heavy snow or ice.

Human-Made Hazards

4.3.10. Building and Structure Collapse

4.3.10.1. Location and Extent

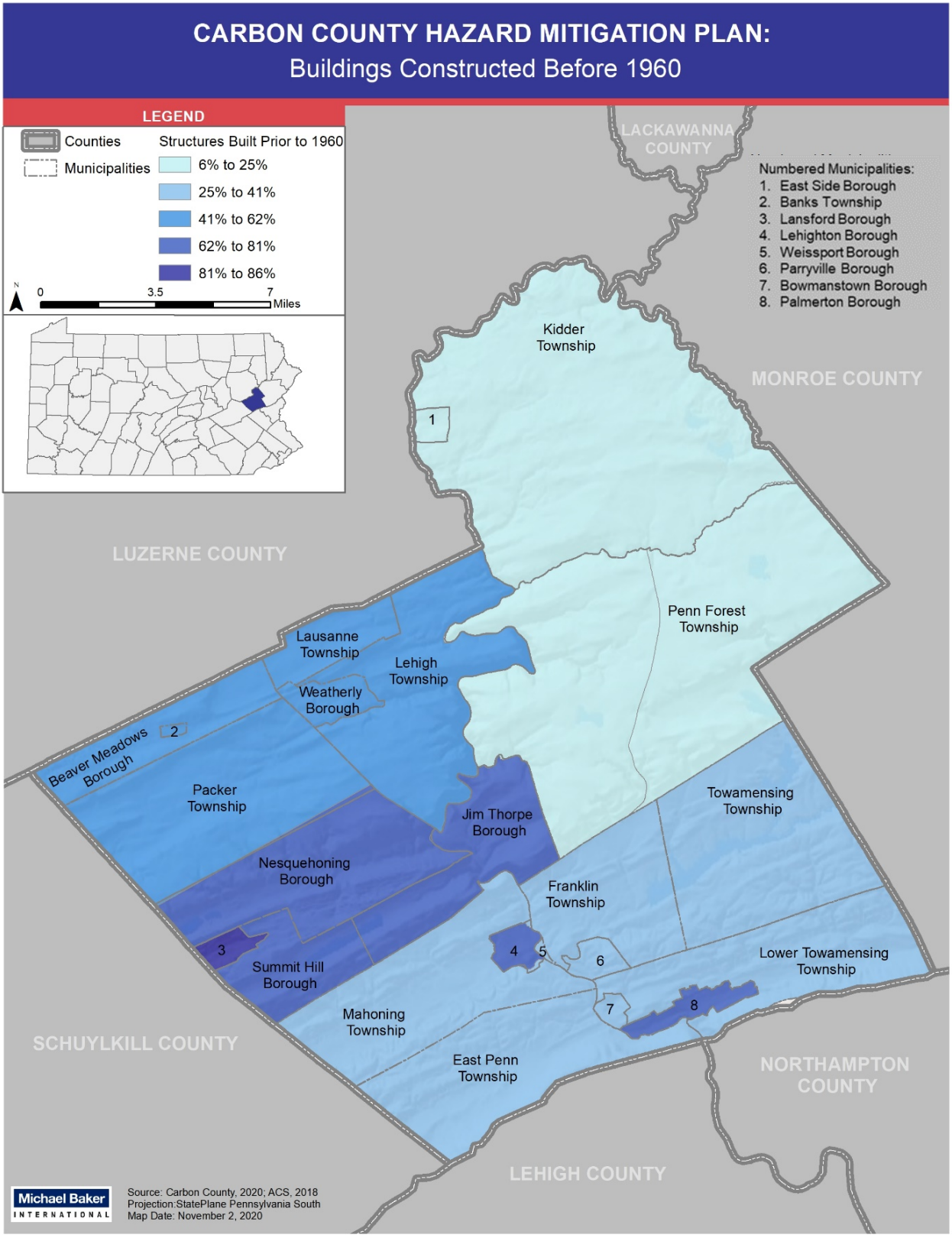
Buildings and other engineered structures, including bridges, may collapse if their structural integrity is compromised, especially due to effects from other natural or human-made hazards. Older buildings or structures, structures that are not built to standard codes, or structures that have been weakened are more susceptible to be affected by these hazards.

Adherence to modern building codes can lower a building's risk to collapse. Building codes – developed by the International Code Council in partnership with FEMA and other federal, state, local, and private authorities – specify the minimum legal design and construction requirements for structural integrity, construction materials, and fire protection (FEMA, 2014). Most buildings constructed after 1961 in Carbon County were built under modern building codes as adopted in the Pennsylvania Uniform Construction Code. Figure 4.3.10-1 shows

proportionally which municipalities have higher percentages of buildings constructed before 1961 in Carbon County.

Bridges serve to connect both large and small roadways and communities throughout the County. Whether they span another roadway or a body of water, bridges are a crucial part of every transportation system. However, many of Pennsylvania's bridge structures are aging and in great need of repair. Inspection and maintenance are necessary to observe and mitigate the extent of the disrepair, especially on older structures.

FIGURE 4.3.10-1 BUILDINGS CONSTRUCTED BEFORE 1960.



4.3.10.2. Range of Magnitude

There are different effects of a collapse, depending on the type and cause of the collapse and the type of structure that collapses. A building collapsing in on itself will likely result in debris field which is dense but has a small footprint. However, if a building collapses in an outward direction, the debris field will be more widely scattered (University of Michigan, 2011). Both of these types of collapses can cause injury to and endanger the lives of those inside or near to the structure and can result in damages to nearby property, especially if the collapse causes a large amount of debris near a populated area. Though occupied buildings are less likely to collapse since they would generally be maintained, more risk of death or injury would be likely with the sudden collapse of an occupied building.

Disrepair can critically affect the integrity of the bridge structure. The level of disrepair depends on how much of the structure is damaged and how critical that portion of the structure is to the safety of drivers. Some structures only need deck replacement or a new superstructure, while others have substructure problems and should be entirely replaced.

As of February 2021, 25 of the 135 bridges on state roads and 9 of the 31 bridges on locally-owned roads were classified as poor in Carbon County. A poor rating was previously referred to as "structurally deficient." This rating does not indicate that a bridge is unsafe, only that there is deterioration to one or more of the major components. Should a bridge be determined to be unsafe, it would be closed. One bridge on a locally-owned road is closed due to structural integrity (PennDOT, 2021). Table 4.3.10-1 lists the breakdown of bridges by owner and rating.

A worst-case scenario for a bridge structure collapse is for a high traffic bridge to collapse during rush hour causing many injuries and several deaths. A worst-case scenario for a building collapse would be for a building with multiple people in it to collapse in a denser area causing injuries and possible death to those in the building as well as around the area.

4.3.10.3. Past Occurrence

There is no comprehensive list of building or structure collapses in Pennsylvania. A notable collapse occurred at a residence in Penn Forest Township in July 2014. A deck collapsed during a child's birthday party injuring six of the attendees. No additional hazards were identified as contributing to the collapse, and the cause of the structural deficiency was not immediately identified (Miller, 2014).

4.3.10.4. Future Occurrence

Structures and buildings can collapse due to deterioration of bridge critical load bearing members and building structural integrity, but external occurrences can also impact bridges and buildings. Pennsylvania has the third-largest number of bridges in the nation, but the most bridges classified as "poor" or "structurally deficient" (PennDOT, 2021). Consequently, the entire commonwealth will see an increased focus on prevention of structure collapse. With at least 21 percent of its bridges in need of repair, Carbon County will continue to face deteriorating structures in the future if these are not addressed.

There have not been many notable issues with building structural integrity in Carbon County, but without proper maintenance and code enforcement this risk can grow. The HMPT noted the anecdotal increase in the amount of blighted and abandoned buildings, which increases the risk of a building collapse in Carbon County. The future occurrence of building and structure collapse can be considered *unlikely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1). Additionally, other hazard events such as fires, winter

storms, and tropical storms could create conditions that would cause buildings or structures to collapse. Information on the future occurrences of such events can be found in their respective hazard profiles.

4.3.10.5. Vulnerability Assessment

The most vulnerable areas of the County are those with the highest concentration of deteriorating structures. Structures can either collapse into themselves or in an outward direction depending on the cause of the collapse. Construction activities, earthquakes, and subsidence can lead to a structure collapsing in on itself. Weather related hazards, including snowfall and wind, and terrorism can cause a building to collapse in an outward direction (University of Michigan, 2011). Since the HMPT determined that Carbon County was not at great risk to earthquakes, subsidence, or terrorism, the greatest risk for collapse is from cascading effects on structures, especially those with lower pre-existing structural integrity, by construction activities, from heavy snowfall during winter storms, from an imbalance of water forces on either side of a structural wall, and from high winds during storms.

In Carbon County, the majority of bridges, over 80%, are owned and maintained by the state, the rest are owned and maintained by the County or local municipalities. PennDOT defines the following bridge terminology for the operational status of bridges (PennDOT, 2018):

- Open – bridge is open to traveling public
- Closed – bridge is closed to vehicular traffic (barriers and signs put in place); pedestrian traffic may or may not be allowed
- Posted – bridge is open but signs have been placed stating a weight limit that can travel across the bridge
- Temp – bridge has temporary supports and/or restrictions in place
- U/CON – bridge is closed due to construction

Additionally, PennDOT defines a poor rating as an indication of the bridge's overall status in terms of structural soundness and ability to service traveling public. If a bridge is marked as poor or structurally deficient, that indicates that the bridge has deterioration to one or more of its major components (PennDOT, 2018).

Table 4.3.10-1 shows the numbers of closed and structurally deficient bridges owned by the state and the County and local municipalities. Countywide, over 21 percent of the bridges have poor ratings. Bridges with a poor rating are often still safe for vehicles to cross over but will need work in the near future. One bridge was closed to vehicular traffic due to its structural deficiencies (PennDOT, 2021).

TABLE 4.3.10-1 THE STATE OF BRIDGE STRUCTURE DETERIORATION IN CARBON COUNTY (PENNDOT, 2021).

BRIDGE OWNER	NUMBER OF BRIDGES	CLOSED BRIDGES	POSTED FOR LOAD	NUMBER OF POOR RATED BRIDGES	PERCENT OF POOR RATED BRIDGES
State Owned	135	0	3	25	18.5%
Locally Owned	31	1	8	9	29.0%
Total	**166**	**1**	**11**	**34**	**47.6%**

4.3.11. Civil Disturbance

4.3.11.1. Location and Extent

Civil disturbance is a broad term that is typically used by law enforcement to describe one or more forms of disturbance caused by a group of people. Civil disturbances are typically a symptom of, and a form of protest against, major socio-political problems. Civil disturbance hazards include the following:

- Famine: Involving a widespread scarcity of food leading to malnutrition, increased mortality, and a period of psychosocial instability associated with the scarcity of food, such as riots, theft of food, and the falls of governments caused by political instability borne of an inability to deal with the crisis caused by famine (Scrimshaw, 1987).
- Economic Collapse, Recession: A breakdown of a national, regional, or territorial economy that typically follows a time of crisis (Chen, 2021).
- Misinformation: Erroneous information spread unintentionally (Makkai, 1970).
- Civil Disturbance, Public Unrest, Mass Hysteria, Riot: Group acts of violence against property and individuals, for example (18 U.S.C. § 232, 2008).
- Strike, Labor Dispute: Controversies related to the terms and conditions of employment, for example (29 U.S.C § 113, 2008).

Typically, the severity of the action coincides with the level of public outrage. In addition to a form of protest against major socio-political problems, civil disturbances can also arise out of union protest, institutional population uprising, or from large celebrations that become disorderly.

The scale and scope of civil disturbance events varies widely. However, government facilities, landmarks, prisons, and universities are common sites where crowds and mobs may gather. Several civil disorder events have been recorded in recent Carbon County history; however, these have all remained relatively peaceful and non-destructive. Demonstrations in the County are most commonly peaceful protests against specific government action. They have been held in parks and in front of government buildings.

4.3.11.2. Range of Magnitude

Civil disturbances can take the form of small gatherings or large groups blocking or impeding access to a building or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot, in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. There are two types of large gatherings typically associated with civil disturbances: a crowd and a mob. A crowd may be defined as a casual temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four categories (Juniata County, PA MJHMP, 2008):

1. Casual Crowd: A casual crowd is a group of people who happen to be in the same place at the same time. Violent conduct does not occur.
2. Cohesive Crowd: A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting a event. They require substantial provocation to arouse to action.
3. Expressive Crowd: An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are

assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest for a cause.

4. Aggressive Crowd: An aggressive crowd is comprised of individuals who have assembled and are visibly angry or violent. This crowd often has leaders who attempt to arouse the members or motivate them into action. Members are noisy and threatening and will taunt authorities. They may be more impulsive and emotional and require only minimal stimulation to arouse violence.

A mob can be defined as a large disorderly crowd or throng. Mobs are usually emotional, loud, tumultuous, violent, and lawless. Similar to crowds, mobs have different levels of commitment and can be classified into four categories (Alvarez and Bachman, 2007).

1. Aggressive Mob: An aggressive mob is one that attacks, riots, and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out of frustrations after political defeat, or violent mobs at political protests or rallies.
2. Escape Mob: An escape mob is attempting to flee something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs are generally difficult to control and can be characterized by unreasonable terror.
3. Acquisitive Mob: An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits a lack of control by authorities in safeguarding property.
4. Expressive Mob: An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent up emotions in highly charged situations.

The worst-case scenario for Carbon County would be an aggressive crowd or an expressive mob protesting on or within a major thoroughfare, most likely formed near a major educational institution or headquarters. This scenario would involve property damage greater than which has ever occurred in the County.

4.3.11.3. Past Occurrence

In June and July of 2020, a series of peaceful protests were held calling for an end to police brutality. One group was given permission by a local restaurant to use their parking lot for a weeklong protest where Routes 209 and 433 intersect (Sicora, 2020). The majority of these demonstrations can be categorized as expressive crowds or small groups. However, on June 2, 2020, one demonstration drew out counter protestors in the Palmerton Borough Park (WNEP, 2020). Verbal disagreements broke out between the opposing demonstrators. While things remained peaceful, there is a risk that a demonstration will draw out opposing crowds that may escalate conditions, bringing the situation into a mob scenario.

In August 2020, residents protested U.S. Postal Service changes causing mail delays. They gathered outside a post office in downtown Jim Thorpe. Leading up to the 2020 presidential election there were concerns about submitting mail in ballots (Kratz, 2020). Most recently, parents and students gathered in Palmerton to demand that schools be kept open during the pandemic. Concerns such as these can be tracked by local officials to predict and prepare for

public demonstrations that could potentially lead to civil unrest, although these crowds remained peaceful.

4.3.11.4. Future Occurrence

Civil disturbance is always a possibility as long as there is discrimination or other perceived social or economic injustices. However, it may be possible to recognize the potential for an event to occur in the near-term. For example, an upcoming significant sporting event at one of the colleges or universities in the Commonwealth may result in gathering of large crowds or immediately after significant national news involving political or social debates. Local law enforcement should anticipate these types of events and be prepared to handle a crowd so that peaceful gatherings are prevented from turning into unruly public disturbances. The probability of civil disturbances occurring in Carbon County is considered *unlikely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.11.5. Vulnerability Assessment

Carbon County is most vulnerable to civil disturbance events in public places where groups of people can gather. These include public parks and government buildings. Demonstrations have also been held along local highways. Protests have occurred in Jim Thorpe Borough and Palmerton Borough, which are both more populated areas. Jim Thorpe is the county seat and is home to several government buildings, so is a likely location for future demonstrations. Country representatives note that likely locations include the County Sherriff's Office, the Emergency Management Agency, and the District Attorney's Office.

Carbon County takes a multi-agency approach to mitigate civil disturbances. Trainings are offered to law enforcement on the National Incident Management System (NIMS) and the Incident Command System (ICS). The Northeast Pennsylvania Regional Counter-Terrorism Task Force recently purchased additional equipment for civil disturbances and has plans to purchase more. County representatives note that frontline officers will receive crowd control training as a response to events in 2020.

Jurisdictional losses for civil disturbance events are difficult to predict and can vary significantly in range. To date, no damage is recorded in Carbon County due to civil disturbance events. If a protest turned into a mob, damage would likely be similar to that seen in other Pennsylvania Counties. In Centre County, for example, a mob of around 1,500 resulted in $150,000 in property damage during the 1998 Central Pennsylvania Festival of the Arts. Crowds celebrating after game-days have resulted in considerable property damage; for example, pulling down poles and signs and tossing objects off of balconies (Centre County, 2021). The communities identified in this section are locations where such events are more likely to occur and therefore should be considered more vulnerable. Adequate law enforcement at these locations minimizes the changes of a small assembly of people turning into a significant disturbance. This will ensure improved response times, optimal communications, and containment of the event as during these events major roadways can be blocked and disturb traffic and larger events may involve the interruption or removal of communication. More broadly, in the case of large civil disturbance events, the County may incur losses related to work stoppages in addition to any acts of vandalism that may occur. Failure to pursue a program of civil disturbance awareness may result in increased loss of lives and property.

4.3.12. **Dam Failure**

The dam failure profile can be found in Appendix H.

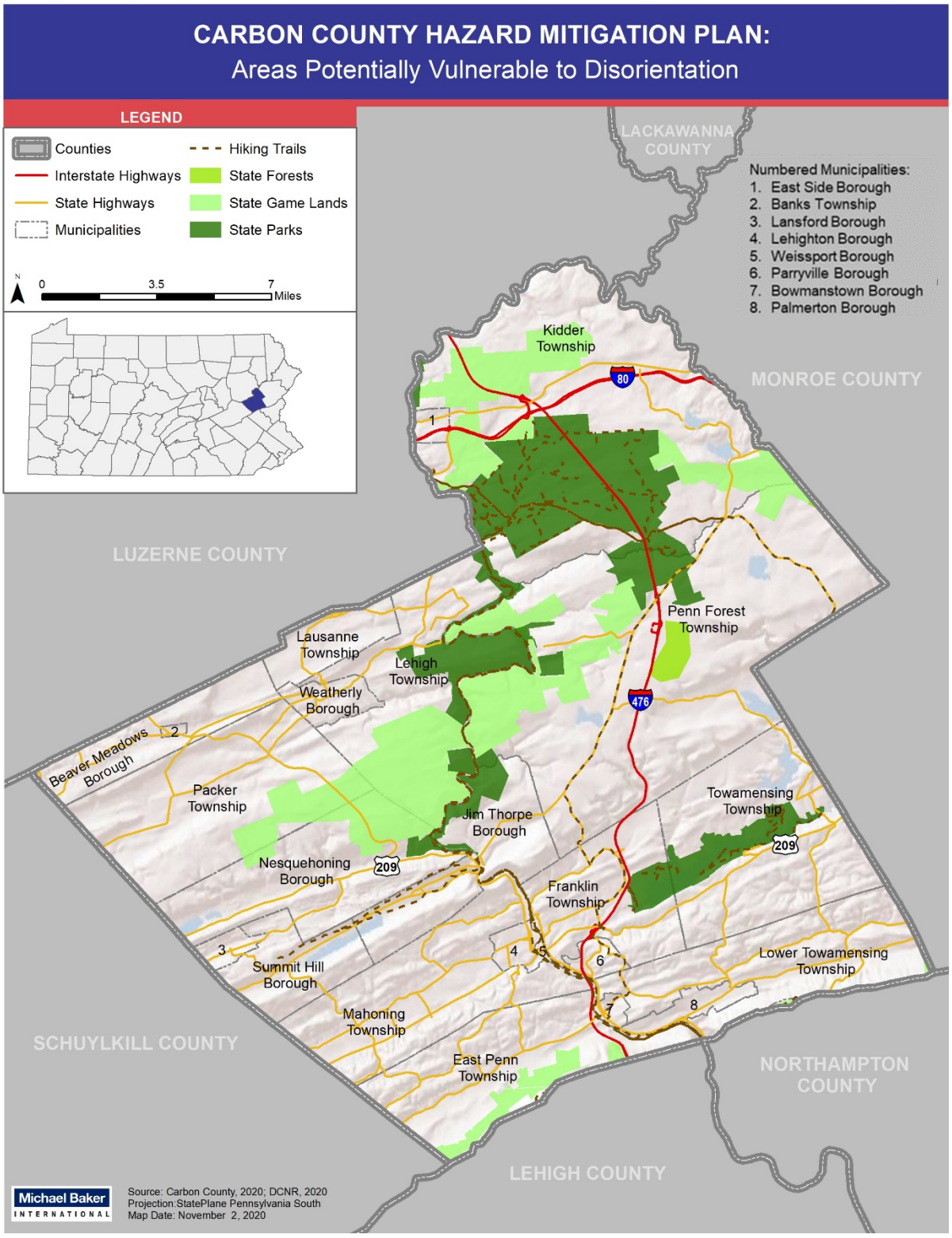
4.3.13. **Disorientation**

4.3.13.1. Location and Extent

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. Carbon County has over 50,000 acres of protected federal, state, and county lands that are wooded. The County is home to Hickory Run State Park, Lehigh Gorge State Park, Belzsville State Park, and multiple State Game Lands areas totaling over 52,000 acres; as well as County managed Mauch Chunk Lake Park with encompasses 2,820 acres of forestland and waterways. In total, Carbon County has a total of 36 named rivers, creeks, and streams, the largest which is the Lehigh River. Search and rescue efforts are focused in and around state forest and state park lands due to the numerous miles of hiking, biking, and water trails. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented.

Carbon County is largely rural and heavily wooded with steep mountains and numerous rivers and streams. Popular outdoor recreational activities include biking, rock-climbing, hiking hunting, fishing, and boating. Nearly 25 percent of Carbon County's land area is forested and includes 80 square miles that the County has designated as state game land, state forest, and state park land as shown in Figure 4.3.13-1. A section of the Appalachian Trail also passes through the County, specifically through East Penn Township, Lower Towamensing, and Palmerton Borough. The HMPT has noted that disorientation risk ranking has increased since the last HMP update due to an increased use of state and County land used for recreation activities.

FIGURE 4.3.13-1 CARBON COUNTY AREAS POTENTIALLY VULNERABLE TO DISORIENTATION.



4.3.13.2. Range of Magnitude

A wide variety of factors can contribute to outcome of a search and rescue mission but the most common dangers associated with disorientation are lack of food, water, shelter, and medical care. Carbon County generally has a constant abundance of water and during the warmer summer months shelter is less of a necessity than during winter months when extreme temperatures can pose a more serious threat. Age, physical fitness, and familiarity with the area can also have a bearing on the outcome. The worst-case scenario associated with disorientation involves serious injury or death.

4.3.13.3. Past Occurrence

Each year several people become lost in Carbon County's wilderness areas. Associated Search and Rescue (SAR) operations use resources such as man-hours and equipment. According to available information no deaths have been reported as a result of disorientation in the County. A detailed, comprehensive list of incidents involving disorientation and SAR is not available for Carbon County.

In July 2020, Carbon County assisted in searching for a missing Carbon County resident. The search was conducted by members of eight fire departments, various police agencies including the Pennsylvania State Police, who used state police helicopters, three search and rescue dog units, drones, dozens of ATVs and individual volunteers. The search and rescue dog units included Northeast Search and Rescue of East Stroudsburg, Wolf Pack Search and Rescue of Allentown and Pa. Search and Rescue of Denver, Lancaster County. (Gower, 2020).

4.3.13.4. Future Occurrence

It is impossible to predict when and where disorientation may occur. During times when activities such as hunting, hiking, biking, and camping increase, so does the likelihood of individuals becoming disoriented. Carbon County continues to gain popularity as a tourist and recreational destination and therefore the probability of future occurrence is expected to increase proportionately. Based on available past occurrence data the probability of the County experiencing a disorientation incident is *likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.13.5. Vulnerability Assessment

Individuals are most likely to become disorientated in areas of vast, open wilderness. Children and the elderly are more vulnerable to the exposure of elements. Bikers, hunters, hikers, and all-terrain vehicle (ATV) riders have been the most common victims of disorientation according to the CCEMA. Many outdoor, recreational activities commonly associated with disorientation take place during the warmer months of spring and summer and pose a somewhat lesser risk because of the average temperature range during these seasons. The most dangerous period to become lost outdoors is during the winter months when heat and shelter are vital. Carbon County often experiences winter storms and temperatures below freezing.

While prevention is the best solution to disorientation, lessening the impacts of this hazard by identifying and quickly locating individuals that have become lost or injured is equally important. There are several resources available on a state and local level for responding to SAR events. The DCNR is the primary coordinator for SAR operations efforts on state lands within Pennsylvania. The agency is responsible for over two million acres of forest land (DCNR, 2020).

Valley Search & Rescue is a volunteer organization based in Lehigh Valley, Pennsylvania just outside Carbon County that provides training and SAR assistance upon request. Additionally,

the Pennsylvania Search and Rescue Council (PSARC) is made up of representatives from DCNR, PEMA, law enforcement, emergency managers and responders, and others. PSARC sets training and operational standards to SAR teams throughout the Commonwealth in addition to mission response coordination and providing SAR prevention and response education to local officials and the public (PSARC, 2020). CCEMA estimates that the cost of disorientation and associated SAR is between $50,000 and $60,000 each year.

4.3.14. Drowning

4.3.14.1. Location and Extent

Drowning accidents can be categorized as unintentional, suicide, homicide, or undetermined depending on the circumstances (PA DOH, 2015). Unintentional drowning can be a significant hazard in communities with numerous water bodies (e.g. ponds, lakes, rivers, etc.) and extensive outdoor recreational activity. In addition, drowning accidents can occur in swimming pools at private residences as above ground pools such as "kiddie pools" and inflatable pools become more popular.

Carbon County has been and continues to grow in popularity as a tourist destination. Water related recreational opportunities such as fishing, boating, and swimming are popular among visitors. Carbon County is most concerned with the consistent drownings occurring in Beltzville Lake in Franklin Township; Mauch Chunk Lake Park; and in the Lehigh River, including in the canal in Franklin Township. There have also been notable but more infrequent drownings in the Francis E. Walter Dam and in the Lake Harmony resort community in Kidder Township.

4.3.14.2. Range of Magnitude

By definition, drowning generally results in death. However, non-fatal drownings can cause brain damage that may result in long-term disabilities including memory problems, learning disabilities, and loss of basic nervous system functions. In a typical year, counties in Pennsylvania can range from having zero to a hundred drowning incidents, depending on factors such as the physical environment (access to water bodies) and a combination of social and cultural issues (wanting to learn how to swim and interest in recreational water-related activities).

Drowning rates are particularly high for children between ages one and fourteen according to the Center for Disease Control (CDC, 2021). Additionally, according to the Center for Disease Control (CDC), drowning is the third leading cause of death from unintentional injury worldwide. In the United States, children under the age of five and adults over the age of eighty-five have the highest risk of drowning. There are many creeks, lakes, rivers, and ponds in Carbon County where various water recreation activities are common. The most prominent locations for water recreation in Carbon County are the Lehigh River and Beltzville Lake.

FIGURE 4.3.14-1 LEHIGH RIVER ACCESS AREA

A secondary hazard from a drowning is the potential for a rescuer to lose their life in their effort of rescuing a drowning person, or recovering a drowned person's body. There is also a hazard of drowning during flash flooding. The National Weather Service has adopted the "Turn Around, Don't Drown" slogan to inform the public of the hazards of traveling through or near flood waters. People often underestimate the force and power of water, especially flood water. Many of the deaths occur in automobiles as they are swept downstream. The next highest percentage of flood-related deaths is due to walking into or near flood waters. A mere six inches of fast-moving water can knock over an adult, and it takes only two feet of rushing water to carry away most vehicles, including sizable pickup trucks and SUVs.

A worst-case scenario would be if one or multiple deaths resulted from drowning.

4.3.14.3. Past Occurrence

There is no official federal, state, or county reporting system for drownings; however, Carbon County 911 has tracked the amount of drownings that occurred between 2009 and 2020.

Table 4.3.12-1 shows the total number of water rescues performed throughout the County. The following incidents were provided by Carbon County Communications Center. Incidents are categorized by how they are called into the 911 Center and now how the incident ends up or what happens at completion of a call. Categories include Fire Dive Response, Fire Rescue Water, EMS Drowning/Near Drowning, and Dive Team Response.

TABLE 4.3.12-1 INCIDENTS OF DROWNING AND WATER RESCUES RECORDED IN CARBON COUNTY (CARBON COUNTY 911, 2021).

Year	Drowning Incidents
2016	6
2017	3
2018	7
2019	7
2020	20
2021	4
Total	48

A Times News Online article provided a "Year in Review" for 2018 Carbon County Drownings & River Rescues. While there were a number of single swimmer rescue events, there were also a number of multi-person rescue events including:

- On June 29, a New Jersey man drowned in the Lehigh River after he was pulled under the water near the bridge trestle, and bystanders lost sight of him. Crews were called back out hours later for another hiker who fell at the Glen Onoko Falls.
- Five people were rescued after getting caught up in Lehigh River rapid waters on July 29.
- A group of 50 rafters in distress had to be rescued in mid-August. The group was rafting with the outfitter Whitewater Rafting Adventures in Nesquehoning.
- On October 21, another rescue effort involving 45 emergency services personnel lasted around four hour (Hedes, 2018).

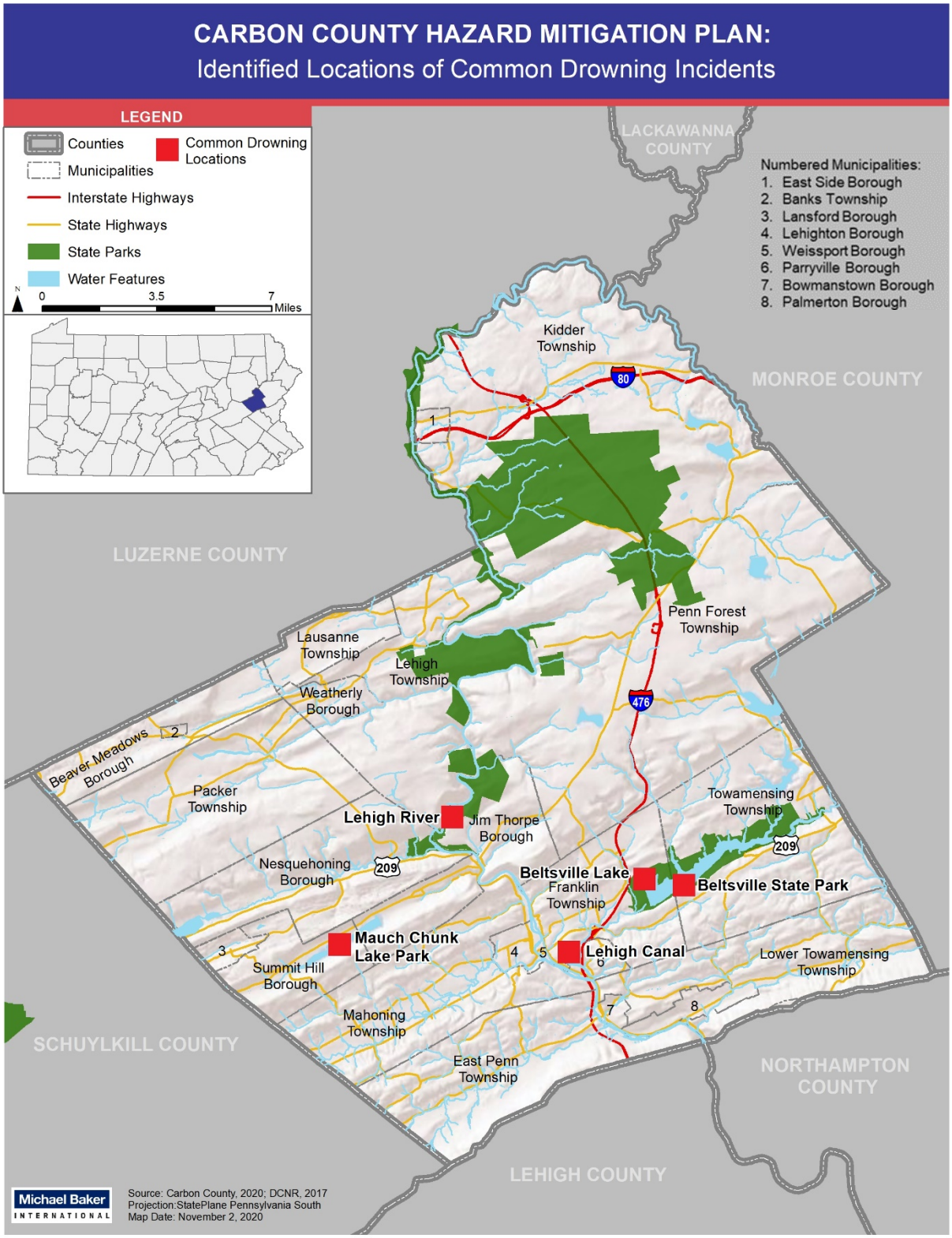
In 2019, the Pennsylvania Game Commission closed Glen Onoko Falls Trail in Carbon County, following at least 10 deaths since 1970 and weekly rescues. Each rescue required between 20

and 25 volunteer first responders, with minimum times between four and six hours, the game commission said (Cassi, 2019).

4.3.14.4. Future Occurrence

It is impossible to predict when and where drowning may occur; however, given past occurrences of drownings in Carbon County, the majority have occurred at Beltzville State Park and Mauch Chunk Lake Park, Lehigh Canal, and in the Lehigh River, see Figure 4.3.14-2. During the warm summer months, as activities such as swimming, boating and fishing increase so does the likelihood of drowning. Carbon County HMPT noted an increase of visitors to the County's parks and recreation areas. The HMPT indicated they felt "Drowning" should have a higher risk ranking than in previous plan updates due to increasing popularity of water recreation. The future occurrence of drowning for Carbon County can be considered *likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

FIGURE 4.3.14-2 IDENTIFIED LOCATIONS OF COMMON DROWNING INCIDENTS.



4.3.14.5. Vulnerability Assessment

As tourism continues to increase in the County and number of visitors grows, drowning is likely to continue without mitigation actions in place. Municipalities that border Beltzville State Park, Mauch Chunk Lake Park, Lehigh Canal, and the Lehigh River are more vulnerable to drownings as their residents have easiest access to the water bodies, see Figure 4.3.13-1. However, residents from other municipalities and from outside the County also frequent the facilities.

4.3.15. Environmental Hazards

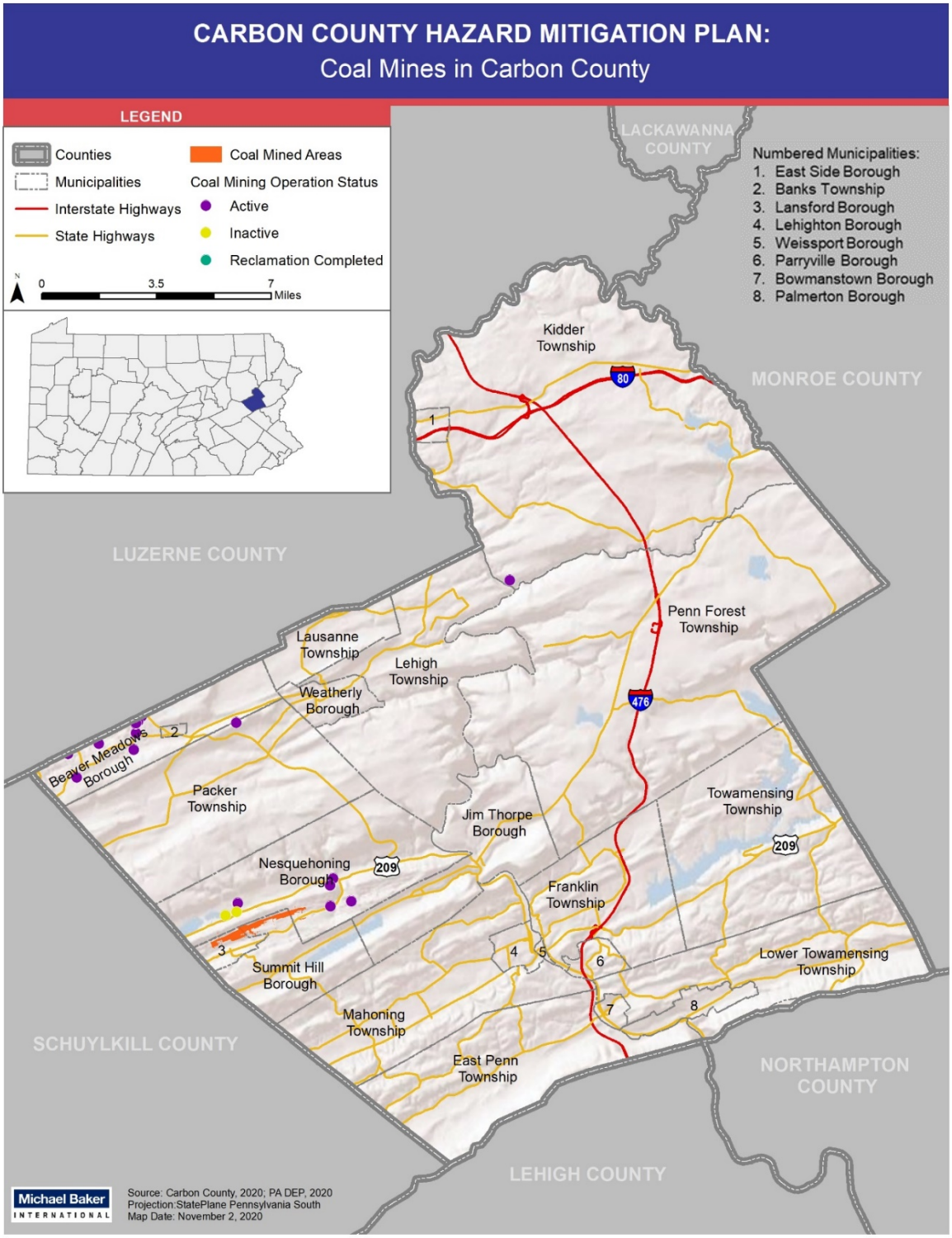
4.3.15.1. Location and Extent

Environmental hazards in Carbon County focus solely on coal mining. This hazard results from human activities and industries and can result in injury and death to humans and damage to property. Additional environmental hazards include hazardous material release, oil and gas well drilling, superfund facilities, manure spills, and product defect or contamination.

Mining, including surface, underground, and open-pit operations, was conducted in Pennsylvania before the 1860s and was instrumental in the development of the Commonwealth. As such, Pennsylvania was one of the first states to initiate, promulgate, and enforce environmental regulations related to mining, including mine reclamation. Active mining continues in Carbon County, which is located over Pennsylvania's anthracite coal field. Figure 4.3.15-1 shows the location of mining operations in the county. Of the mapped operations, 21 are active and 2 are inactive.

There remains a legacy of abandoned mines, waste piles, and degraded groundwater and surface water in the Commonwealth. The EPA estimates that over 3,000 miles of streams in Pennsylvania have been contaminated by acid mine drainage which occurs when metal sulfides in rock oxidize and generate acidity in water that comes in contact with them.

FIGURE 4.3.15-1 ACTIVE, INACTIVE, AND RECLAIMED COAL MINES IN CARBON COUNTY.



4.3.15.2. Range of Magnitude

Major impacts from mining include surface-elevation changes and subsidence, modification of vegetation, the chemical degradation and flow redistribution of surface water and groundwater, the creation of mine voids and entry openings, adverse aesthetic impacts, and changes in land use.

In addition, active and abandoned mines can also result in injury and loss of human life. This can occur in active mines where workers are injured or killed by mine collapse, entrapment, poisonous gases, inundation, explosions, fires, equipment malfunction, and improper ventilation. Injuries and death, such as ATV accidents and drowning, can also occur in abandoned mines.

The mineral-waste disposal from coal mining is also a hazard. Past disposal practices have dotted Pennsylvania's landscape with unsightly refuse piles. Many of the refuse piles contain combustible materials that cause long-term air-quality problems if ignited. Burning refuse piles have also been linked to major underground coal fires, such as those at Centralia and Shamokin in the Anthracite region of Pennsylvania.

Slurry ponds or tailings dams are potentially dangerous. Mineral byproducts from coal mining are pumped to slurry or tailings dams for removal by sedimentation. If the dams or structures supporting the slurry ponds fail, they pose hazards similar to dam failure (see section 4.3.12).

Reject wastes from coal mining that contain sulfide minerals can also degrade groundwater and surface water that comes into contact with them. Coal refuse piles have historically been prolific sources of acid mine drainage which has impaired many streams in Pennsylvania.

Pennsylvania has a long history of mining, and there have been numerous mining accidents. The worst-case scenario event in Pennsylvania mining history occurred in 1962 in Centralia, Pennsylvania, when an underground fire began in the coal mines underneath the town. The federal government offered buyouts of homes of residents so they could relocate from Centralia, resulting in a cost of over $40 million to carry this out and demolish homes. In 1992, Pennsylvania claimed eminent domain on all properties in the town and condemned all of the buildings. In 1981 the town had over 1,000 residents, but today only a few remain.

One of the worst mining accidents in the United States since 1950 occurred in nearby West Virginia. On April 5, 2010, twenty-nine miners were killed at the Upper Big Branch Mine by an explosion.

The environmental impacts of coal mining are many. Mining activities and acid mine drainage can contaminate surface and groundwater, create acid mine drainage, and cause changes in water temperature and damage to streams, lakes, ponds, estuaries, and wetland ecosystems. Mine explosions or burning refuse piles can cause air quality problems. Although mine reclamation is required for much surface mining activity, there is still a loss of quality in landscape, damage to vegetation, and habitat.

4.3.15.3. Past Occurrence

Although state and federal (U.S. Department of Labor, EPA, and the Office of Surface Mining and Reclamation) laws require occupational health, safety, and environmental protection in all mining activities, mining accidents still occur. The U.S. Department of Labor Mine Safety and Health Administration tracks mining fatalities. Between 2015 and 2020, there were 14 mining fatalities. MSHA also tracks accidents and injuries. In Carbon County, the most recent full year of data was in 2019 which tracked 141 accidents. There is no comprehensive database that

tracks all data. Beyond operator accidents, there can be incidents that are a result of falls, drowning, electrocution, and ATV crashes.

The DEP Bureau of Mine Safety is required by law to investigate all fatal and serious accidents that occur at underground Commonwealth mines. According to the Bureau, there have been four major mine emergencies in Pennsylvania coal mines. They define a mine emergency as a serious situation or occurrence that happens unexpectedly and demands immediate action or a condition of urgent need for action or assistance such as a state of emergency. Two of these were mine fires and two were inundations (PADEP, 2010). In 2019, The DEP Bureau of Mine Safety did not report any fatal or non-fatal accidents at anthracite or bituminous coal mining sites in Carbon County.

A recent mine fire in the County has impacted communities in Banks Township and Beaver Meadows. In July 2015, a fire was ongoing both on abandoned and actively mined land at the Jeansville Mine off of Route 93 near the Luzerne County line. Smoke from the fire is emitted an intense sulfer smell in the area, which caused concern among area residents about the impact to air quality. (Lee, 2015).

4.3.15.4. Future Occurrence

It is difficult to forecast the severity and frequency of coal mining accidents and environmental damage in Pennsylvania. Although throughout time, the government has strengthened mining and reclamation operation and environmental regulations, permitting, and inspection criteria, this has not prevented mining accidents and environmental damage from occurring.

Surface subsidence resulting from underground mining continues to be a major concern of those impacted by the mining industry. Despite the use of deep mine roof-support methods, some subsidence will eventually occur.

It is likely that Pennsylvania will continue to modify its laws to reflect additional environmental awareness. Stricter controls on reclamation, perhaps specifically addressing the disposal of mining residuals, are likely. State and federal laws and programs have historically placed an emphasis on environmental preservation and reclamation. As in the past, it seems likely that Pennsylvania will be at the forefront of these programs and future occurrence will decrease. The future occurrence of environmental hazards for Carbon County can be considered *possible* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.15.5. Vulnerability Assessment

The vulnerability of jurisdictions to coal mining incidents is defined as populations living within 1.5 miles of active coal mines. Table 4.3.15-1 provides this vulnerability information by community. As seen from the table, municipalities in the County that are most vulnerable to coal mining are Beaver Meadows Borough, Banks Township, Lansford, and Nesquehoning Borough.

TABLE 4.3.15-1 POPULATION VULNERABLE TO COAL MINING

Municipality	2010 Population	Estimated Population Within 1.5 Miles of an Active Coal Mine	Percent Population Within a 1.5 Miles of an Active Coal Mine
Banks Township	1,685	1250	74%

Beaver Meadows Borough	869	866	100%
Bowmanstown Borough	937	0	0%
East Penn Township	3,135	0	0%
East Side Borough	319	0	0%
Franklin Township	4,275	0	0%
Jim Thorpe Borough	4,781	6	0%
Kidder Township	2,269	0	0%
Lansford Borough	3,941	3926	100%
Lausanne Township	248	32	13%
Lehigh Township	528	15	3%
Lehighton Borough	5,498	0	0%
Lower Towamensing Township	3,363	0	0%
Mahoning Township	4,361	0	0%
Nesquehoning Borough	3,431	3144	92%
Packer Township	1,230	369	30%
Palmerton Borough	5,468	0	0%
Parryville Borough	512	0	0%
Penn Forest Township	9,915	2	0%
Summit Hill Borough	3,075	143	5%
Towamensing Township	5,056	0	0%
Weatherly Borough	2,525	0	0%
Weissport Borough	412	0	0%
Grand Total	67,833	9,753	14%

4.3.16. Levee Failure

4.3.16.1. Location and Extent

A levee is a man-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 reduce the risk from temporary flooding (FEMA, 2016). Breaches of these structures occur when they are overtopped or physically incapable of containing the pressure exerted by the floodwaters. If a levee breaks, many properties may be quickly submerged in floodwaters and residents may become trapped by rapidly rising water. The failure of levees has the potential to result in loss of life, property damage, and substantial economic impacts, for example damage to infrastructure or agriculture.

According to the USACE National Levee Database (NLD), there is only one levee in Carbon County located in Weissport Borough along the Lehigh River (USACE, 2021a). Levee systems can be Federal or Non-Federal projects. Federal projects are congressionally authorized projects that are generally planned, designed and constructed by USACE and a cost-sharing levee sponsor. Levees require maintenance to continue to provide the level of protection for which they were designed and built. Maintenance and operational responsibilities, referred to as sponsorship, belong to a variety of entities including levee districts, water management districts, local governments, state governments, and tribal governments.

The Weissport Levee System consists of an earthen levee first constructed in 1934 as a federal Civil Works Act project and was expanded in 1960s. The entire levee is approximately 4,900 feet long. Starting upstream, an earthen tie-back section across the Lehigh Canal connects to 800 feet of earthen levee with riprap riverside protection. Past the railroad embankment and extending 1,400 feet downstream is the Civil Works Act project. This portion of the levee has a slushed concrete facing and was raised slightly by the Commonwealth of Pennsylvania. The remaining 2,700 linear feet of levee was constructed in the 1960s by the Commonwealth of Pennsylvania. The downstream portion also has two ponding areas and several drainage features, and ties into a railroad embankment at its downstream end.

The levee system is operated and maintained by Weissport Borough. The leveed area consists of residential, commercial, and light industrial uses. The project has performed as designed since construction. This levee is not accredited, meaning it does not provide protection from 1%-annual-chance floods. Figure 4.3.16-2 shows the levee system and the flood zones along the Lehigh River and Figure 4.3.16-1 provides details of the base flood elevation and the 0.2%-annual-chance flood area, demonstrated in the X shaded area of the map.

FEMA plays an important role in helping local officials and community members understand the risk of flooding in levee-impacted areas. While levees can reduce the risk of flooding, they do not eliminate it. Levees do not “protect” lives or property from flooding. Rather, they reduce risk. The primary way that FEMA communicates flood risk in levee-impacted areas is through its FIRMs. These maps show the areas with low, moderate, and high risk of flooding during a 1-percent-annual-chance flood, or a flood that has a one-percent chance of happening in any given year. The FEMA flood maps for Carbon County became effective in June 2002 and show flood hazards in levee-impacted areas based on the best available data at that time. More information on Carbon County’s floodplain maps can be found in section 4.3.2.

FEMA is currently involved in the process of updating flood maps for areas impacted by major levee systems across the country. While the flood map for the Weissport Levee System was not

being updated during this plan update process, it is important to note how map updates may affect flood risk and insurance. The map update process involves re-evaluating the extent of the area that could be flooded, as well as re-evaluating the level of risk reduction provided by each levee system. If a levee system meets certain Federal requirements to show that it is tall enough, strong enough, and property operated and maintained (those in Code of Federal Regulations, Title 44, Chapter 1, Section 65.10), FEMA will recognize, or "accredit," the levee as reducing the hazard from the 1-percent-annual-chance-flood. Although there is still a risk of flooding in the levee-impacted area, FEMA will show the area as moderate risk instead of high risk (FEMA, 2016). It is important that residents, businesses, local officials, and other stakeholders recognize that the flood hazards shown in levee-impacted areas on the effective FIRM have not been updated to reflect the latest available data. It is critical that property owners understand their risk and take the appropriate steps to mitigate it.

FIGURE 4.3.16-1 LEVEE SYSTEM IN CARBON COUNTY ALONG THE LEHIGH RIVER.

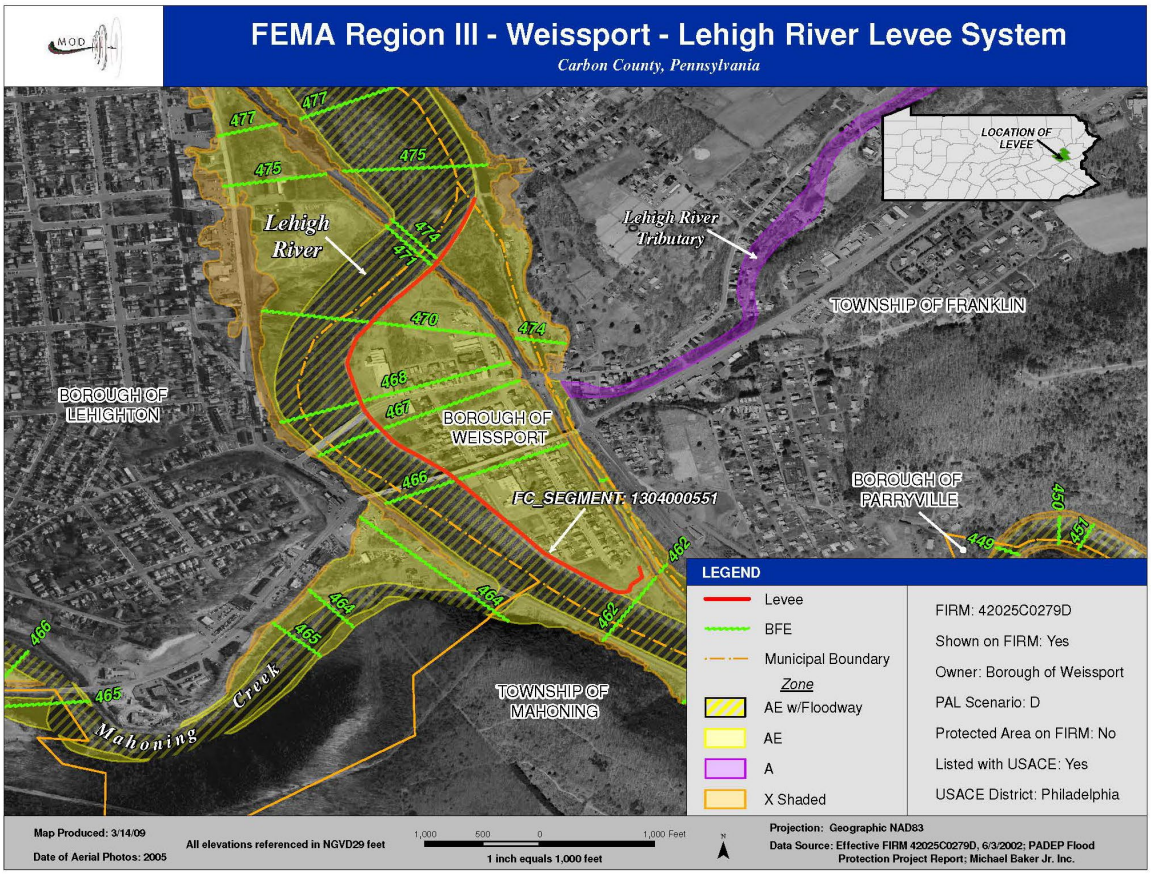
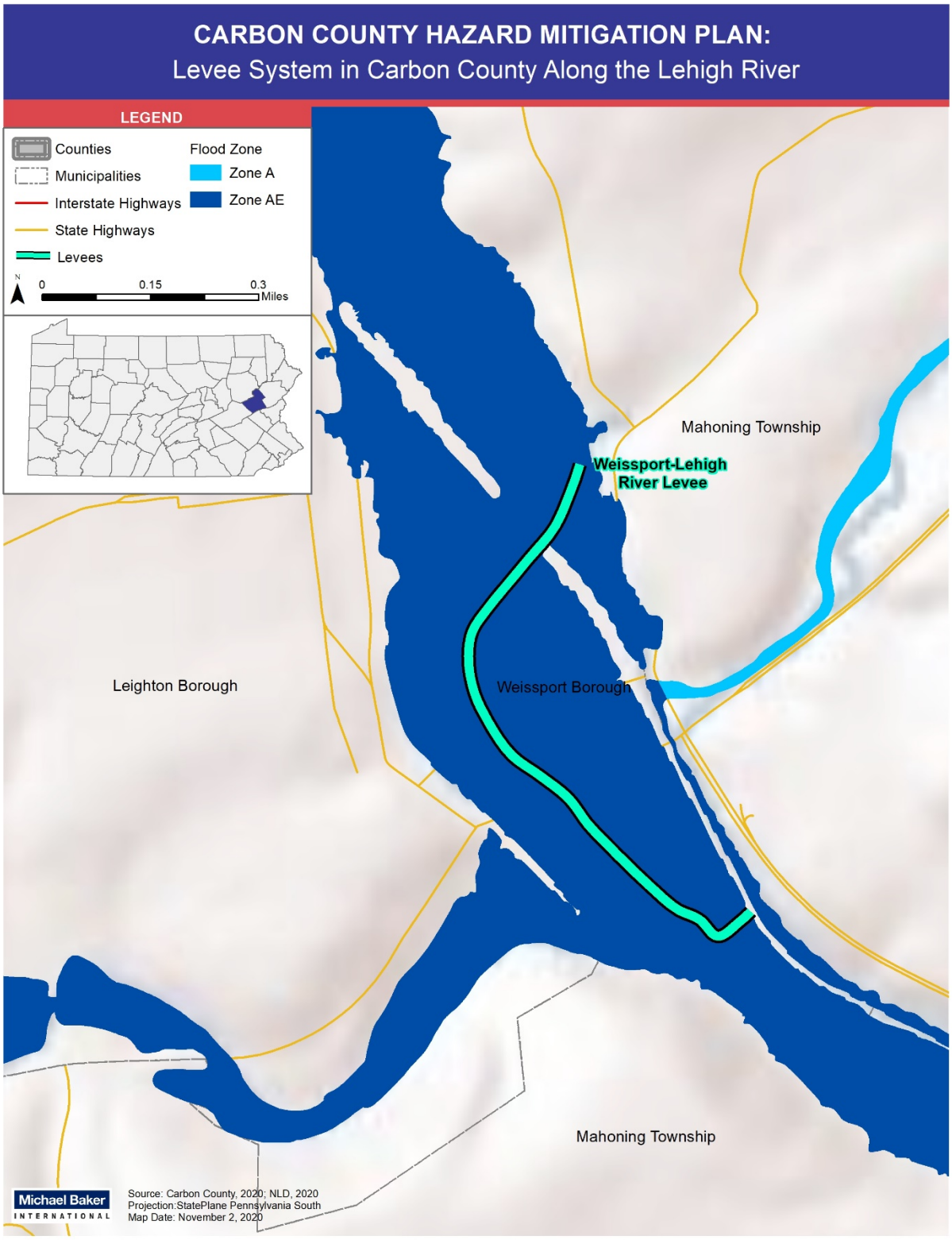


FIGURE 4.3.16-2 LEVEE SYSTEM IN CARBON COUNTY ALONG THE LEHIGH RIVER.



4.3.16.2. Range of Magnitude

Flood-related hazards due to levee failures range in magnitude including: overtopping, when the water-level rises over the top of the levee; back-ending, when water flows around the back of the levee, outside of the edge of the levee system; and total failure as seen during Hurricane Katrina. Levees are typically designed with three feet of freeboard to prevent overtopping, but older levees were not built to that standard (FEMA, 2016).

A levee failure or breach causes flooding in landward areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating depending on the level of flooding for which the structure is designed and the amount of landward development present. In some instances, the magnitude of flooding could be more severe under a levee failure event compared to a normal flooding event. If an abrupt failure occurs, the rushing waters of a flood wave could result in catastrophic losses.

Properties located in the area of reduced risk landward of a levee system are not subject to the mandatory flood insurance purchase requirement of the National Flood Insurance Program. Thus, regardless of whether a levee is accredited, there is concern that properties in these areas lack flood insurance. In the event of a failure, it is likely that inundated properties will not be insured.

The environmental impacts of a levee failure result in significant water quality and debris disposal issues. Flood waters will back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooding waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Water supplies and wastewater treatment could be off-line for weeks. After the flood waters subside, contaminated and flood damaged building materials and contents must be properly disposed. Contaminated sediment must be removed from buildings, yards, and properties.

The worst-case levee failure is one which occurs abruptly with little warning and results in deep, fast-moving flood waters through a developed or populated area. The potential for this worst-case scenario to occur in Carbon County is possible since the levee is located in a populated area of Weissport Borough.

4.3.16.3. Past Occurrence

There are no known previous levee failures in Carbon County. However, the levee system has experienced damages to the riprap protection on the creek side slope of the levee during high-water events in 1996, 2005, and 2006 (USACE, 2021a).

4.3.16.4. Future Occurrence

Given certain circumstances, levee failures can occur at any time. However, the probability of future occurrence can be reduced through proper design, construction, and maintenance measures. The age of the levee can increase the potential for failures if not maintained. In Pennsylvania, the average age of federally authorized and non-federally authorized levee systems is 50 years, the typical lifespan of a levee (ASCE, 2018).

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 percent-annual-chance flood, other levees may be designed to protect against smaller or larger floods. Design specifications provide information on the percent-annual-chance flood a structure is expected to withstand, provided that it has been adequately constructed and maintained. Levee failure is also influenced by the

frequency and severity of flood events. Therefore, potential future changes in climate and weather conditions, such as predicted increases in heavy precipitation events, may impact the future occurrences of levee failure. For more information on the future occurrence of flood events, please see Section 4.3.2. Overall, the future occurrence of levee failures for Carbon County can be considered *unlikely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.16.5. Vulnerability Assessment

The Weissport Borough levee does not provide protection to the 1%-annual-chance event. However, this levee may provide some measure of protection during a lesser storm to structures in Weissport Borough. The National Levee Database notes that the population at risk in the leveed area was calculated to be 756, and the value of property in the leveed area was calculated to be $35.6 million (USACE, 2021a). The HMP identifies the structures and critical facilities vulnerable to levee failure in Weissport Borough, shown in Table 4.3.15-1. This should be considered a broad estimate of structures potentially vulnerable to levee failures.

TABLE 4.3.15-1 STRUCTURES AND CRITICAL FACILITIES VULNERABLE TO LEVEE FAILURE.

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN LEVEE PROTECTED AREA	PERCENT STRUCTURES IN PROTECTED AREA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN LEVEE PROTECTED AREA	PERCENT CRITICAL FACILITIES IN PROTECTED AREA
Weissport Borough	203	203	100.00	3	3	100.00

4.3.17. Nuclear Incidents

4.3.17.1. Location and Extent

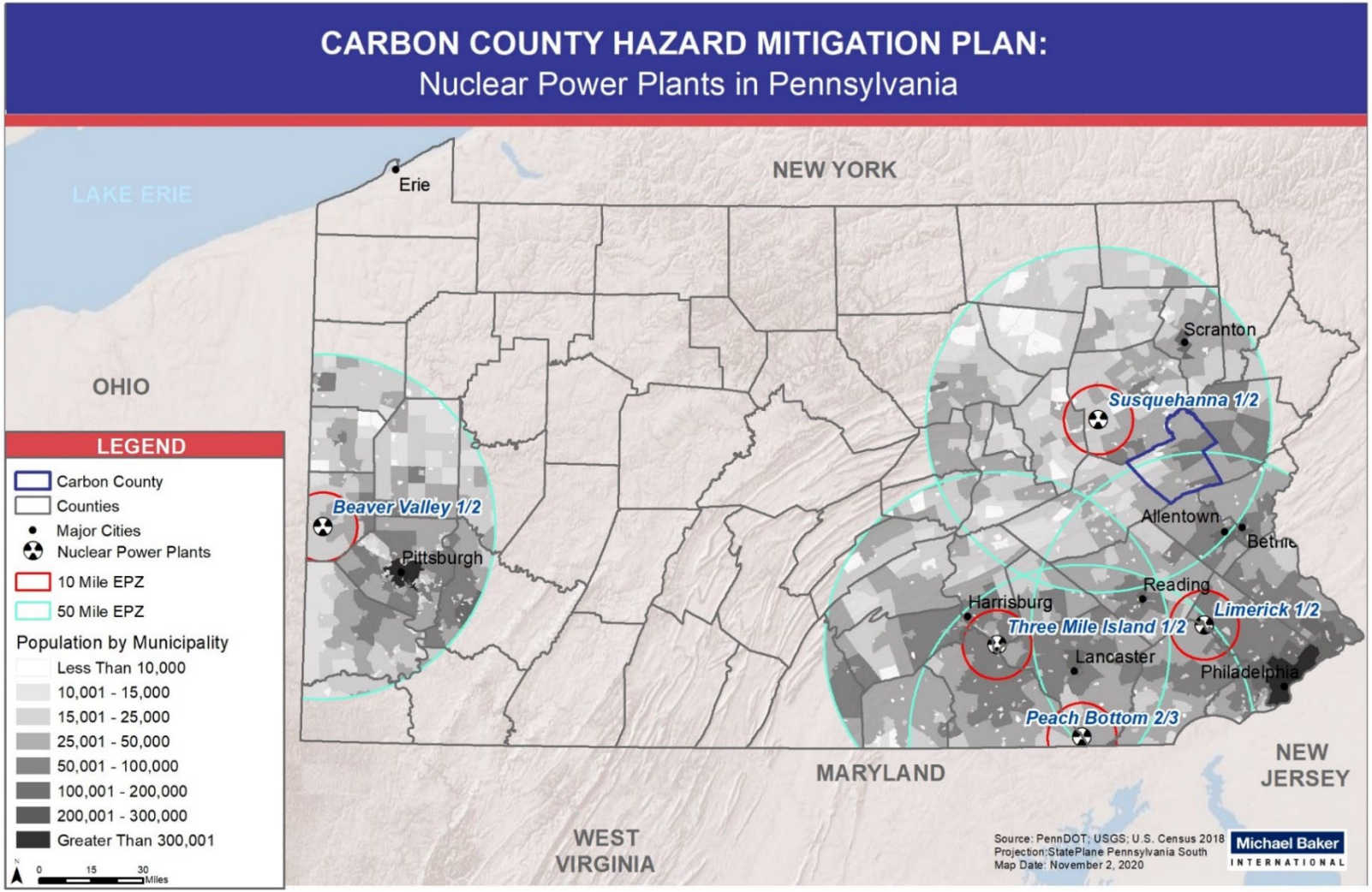
Nuclear Incidents generally refer to events involving the release of significant levels of radioactivity or exposure of workers or the general public to radiation. The primary concern following such an incident or accident is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects (US EPA, 2021).

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

As seen in Figure 4.3.17-1, Carbon County is not located within the ten-mile Plume Exposure Pathway EPZ of any nuclear facility. However, it is completely within the fifty-mile Ingestion Exposure Pathway EPZ for the Susquehanna Steam Electric Station, located approximately twenty miles northwest of the County border, in Salem Township, Luzerne County, Pennsylvania. In addition, the bottom portion of the County's land area is located within the

Ingestion Exposure Pathway EPZ of the Limerick Generating Station, located approximately forty miles to the southeast in Limerick Township, Montgomery County, PA. The remaining three nuclear plants in Pennsylvania are more than fifty miles away from Carbon County. This distance exceeds the Plume Exposure and Ingestion Exposure Pathway EPZs for nuclear emergencies; therefore, these facilities are considered a minimal threat to the County. However, in the event of an emergency, evacuees from distant EPZs may seek shelter in Carbon County. According to PEMA there are over 1.1 million people at risk in the Ingestion Exposure EPZ of the Susquehanna Steam Electric Station, and over 5.8 million people at risk in the Ingestion Exposure EPZ of the Limerick Generating Station (PEMA, 2019).

FIGURE 4.3.17-1 CARBON COUNTY'S LOCATION IN RELATION TO THE 10-MILE AND 50-MILE EPZS OF PENNSYLVANIA NUCLEAR POWER PLANTS.



4.3.17.2. Range of Magnitude

Nuclear accidents/incidents can be placed into three categories:

- Criticality accidents: Involves loss of control of nuclear assemblies or power reactors.
- Loss-of-coolant accidents: Occurs whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system.
- Loss-of-containment accidents: Involves the release of radioactivity from materials such as tritium, fission products, plutonium, and natural, depleted, or enriched uranium. Points of release have been containment vessels at fixed facilities or damaged packages during transportation accidents.

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 EPZ refers to whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to months depending on the proximity to the point of radioactive release; however, the Plume Exposure Pathway EPZ is not a significant concern for Carbon County because it is located more than 10 miles from all nuclear facilities.

Carbon County focuses on the impact of the Ingestion Exposure Pathway EPZ. This EPZ refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation. This kind of exposure can stem from any of the three categories of nuclear accident. Potential environmental impacts specific to the 50-mile Ingestion Exposure Pathway EPZ include the long-term effects of radioactive contamination in the environment and in agricultural products (US EPA, 2021). Carbon County can expect some radioactive contamination in very small amounts in the case of a nuclear incident. 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 in humans. There is an increased cancer risk over decades for people who have ingested radiation. The damage to cells and internal organs may be mild to severe, depending on the amount of radiation ingested and the number of years over which the ingestion occurred. 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.

Nuclear facilities must notify the appropriate authorities in the event of an accident. NRC uses four classification levels for nuclear incidents (NRC, 2020a):

- Unusual Event: Under this category, events are in process or have occurred which indicate *potential degradation in the level of safety of the plant*. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.
- Alert: If an alert is declared, 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.

- Site Area Emergency: A 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 Protective Action Guides except near the site boundary.
- General Emergency: A 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 Protective Action Guides for more than the immediate site area.

A worst-case scenario for Carbon County would be if a General Emergency occurred at Susquehanna Steam Electric Station that leaked sufficient radiation to create longer-term damage in the form of contaminated water, soil, and food supplies in the County. The North Shore Railroad Company runs branch line service along the West shore of the Susquehanna River. This service stops at the Susquehanna Steam Electric Station and other industries along the line. A rail accident or trail derailment at this facility could cause significant challenges in Carbon County.

4.3.17.3. Past Occurrence

The accident at the Three Mile Island Generating Station in March 1979 remains the nation's only nuclear incident at the *General Emergency level* and remains the worst nuclear incident on record in Pennsylvania. During this incident, equipment malfunctions, design-related problems, and worker errors led to a partial meltdown of the TMI Unit 2 reactor core at TMI (NRC, 2018).

Carbon County has not been directly affected by a nuclear incident. There have been no failures at the Susquehanna Electric Station or the Limerick Nuclear Power Station that have resulted in damages, injuries, or fatalities. The 2020 Luzerne County Hazard Mitigation Plan states that the nuclear power generating plant had one 'Alert' declared on March 2, 2006 (Luzerne County, 2020). Alerts are the second lowest of four emergency classifications for nuclear power plants. Alerts are declared when an event has occurred that could reduce the plant's level of safety, but backup plant systems still work.

Nuclear incidents rarely occur, but the incident at Three Mile Island is the worst fixed-nuclear facility accident in US history. The resulting contamination and state of the reactor core led to the development of a fourteen-year cleanup and scientific effort. Additionally, the *Presidents' Commission on the Accident at Three Mile Island examined* the costs of the accident, concluding, "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 $1 billion supports the argument that considerable additional resources can be cost effective if spent to guard against future accidents" (US DHS, 1979).

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 to the population in the vicinity of the plant. However, one study conducted by the DOH'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" (NEI, 2019).

The most recent nuclear incident to occur worldwide was that which involved the Fukushima Daiichi nuclear reactor in Okuma, Fukushima, Japan. This incident occurred on March 11, 2011. An earthquake in the area resulted in a series of equipment failures, nuclear meltdowns, and releases of radioactive materials. These failures and releases were largely attributed to the water that penetrated the structures following the tsunami that was generated by the earthquake. The flooding caused the failure of multiple generators meant to keep the systems operating safely after the automatic shutdown. The World Health Organization completed a report that indicated there were only small proportional increases in the occurrence of certain cancers following the radiation exposure from the plant (WNA, 2021).

4.3.17.4. Future Occurrence

Pennsylvania is home to the only nuclear power plant *General Emergency* in the nation. 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 one of the five nuclear generating facilities in the Commonwealth. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development notes that studies estimate the chance of protective barriers in a modern nuclear facility at less than one in 100,000 per year (NEA, 2005).

Across the United States, several *Unusual Event* and *Alert* classification level events occur each year at the 100+ nuclear facilities that warrant notification of local emergency managers. Of these, *Alert* emergencies occur less frequently. For example, in 1997, there were forty notifications of *Unusual Events* and three *Alert* events nationwide. Based on historical events, *Site Area Emergency* and *General Emergency* incidents are very rare. Therefore, the future occurrence of nuclear incidents that affect Carbon County can be considered *unlikely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.17.5. Vulnerability Assessment

Carbon County is located entirely within the Ingestion Pathway EPZ of the Susquehanna Steam Electric Station, and 75% of the County's population is located within the Ingestion Pathway EPZ of the Limerick Generating Station. As a result, the entire County is vulnerable to the contamination effects possible in a nuclear incident.

As stated above, the County's primary vulnerability to nuclear incidents comes in the form of food, soil, and water contamination. In terms of vulnerable land, the 19,498 acres of farmland held in Carbon County's 200 farms are vulnerable to radiological contamination in a nuclear incident. In 2017, the market value of all agricultural products of these farms exceeded $13 million (USDA, 2017). Additionally, Carbon County hosts 32,576 acres of what the National Resources Conservation Service (NRCS) considers "Prime Farmland" which could become contaminated, whether or not this land is currently being used to grow crops (NRCS, 2000). "Prime Farmland" refers to land that has the best combination of physical and chemical

characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses (NRCS, 2015).

While unlikely that all agricultural products would be lost in the event of a nuclear incident, the County can expect some portion of the $13 million in agricultural products 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.

Water contamination is also a concern in nuclear incidents. There are twelve public water suppliers that operate in the County or provide water to municipalities in the County, which are listed in Section 4.3.1.5. These water supplies, coupled with the County's 6,394 domestic drinking water wells, are all vulnerable to the effects of a nuclear incident.

The loss experienced by each jurisdiction in the case of a nuclear incident will depend on the magnitude of the event. The example of the Three Mile Island incident gives an indication of local and regional economic loss, though. The *President's Commission on the Three Mile Island Incident* calculated the economic impact of the accident, looking at direct and indirect losses and other potential growth impacts. Direct impacts to the manufacturing sector were estimated at $6.3 million (US DHS, 1979). These losses occurred within a few days after the accident and quickly subsided thereafter with no evidence of permanent layoffs resulting. Food processors also incurred expenses with some farms purchasing equipment to detect radiation levels and converting dairy production to powered milk.

The utility itself incurred significant costs in the areas of emergency management and plant refurbishment and replacement power. Emergency management costs ran in the hundreds of millions of dollars and replacement power for both units at a cost of $24 million a month. The unaffected unit TMI Unit 1 was shut down for 6.5 years. During this time, more than $100 million in plant upgrades and refurbishment took place. Replacement power costs today are estimated at nearly twice the 1979 dollars. Cost of the accident cleanup and placing the facility in monitored storage cost approximately $1 billion.

The impact to tourism was estimated at approximately $6.5 million with lost wages in this sector estimated from $2.8 million to $3.8 million. Losses to the agricultural sector appeared to be minimal due to off-growing season. The Pennsylvania Department of Agriculture indicated that losses were significantly less than $1 million.

The accident at Three Mile Island had a profound effect on the residents, 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 this accident. Afterwards, comprehensive, coordinated, and exercised plans were developed for the state, counties, school districts, special facilities (hospitals, nursing homes, and detention facilities) and municipalities to assure the safety of the population. Costs associated with an event at a nuclear facility, be it real or perceived, are significant. The mitigation efforts put in place immediately following the 1979 incident continue today. The Commonwealth 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 involved with the five nuclear facilities is an ongoing effort. Plans are reviewed and amended on an annual basis. Recent amendments

to various planning documents and station procedures include the efforts to enhance station security measures and the means to bolster communication and response in the event of terrorist activities.

The nuclear industry has adopted pre-determined, site-specific Emergency Action Levels (EALs). The EALs provide the framework and guidance to observe, address, and classify the severity of site-specific events and conditions that are communicated to off-site emergency response organizations (NRC, 2020b). There are additional EALs that specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or facility attack. These EALs ensure that appropriate notifications for the security threat are made in a timely manner. Each facility is also equipped with a public alerting system. 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 of Pennsylvania Emergency Operations Center. State officials also have the capability to send emergency messages as text messages to mobile devices.

Following the Fukushima incident in Japan, the United States Nuclear Regulatory Commission developed a set of recommendations based on the lessons learned. These recommendations are meant to enhance reactor safety for US-based nuclear reactors against a variety of factors. Recommendations included the categories of regulatory framework, ensuring protection (of the facilities and equipment), enhancing mitigation, strengthening emergency preparedness and improving the efficiency of NRC programs. One of the specific recommendations involved the re-evaluation and upgrade of seismic and flooding protection of structures, systems, and components for each reactor (NRC, 2020c). As more information comes out, and more lessons learned are developed, it should only serve to reinforce the protections in place against any type of incident involving nuclear power stations.

4.3.18. Transportation Accidents

4.3.18.1. Location and Extent

For the purposes of this plan, transportation accidents are defined as incidents involving highway, air, or rail travel, as well as accidents involving hazardous materials. This analysis includes the location of all public airports, passenger and freight rail lines, and highways where major accidents are likely to occur.

Traffic accidents and rail accidents can occur anywhere along their respective corridors in Carbon County. Aviation accidents typically occur within 5 miles of take-off or landing but can occur countywide. Table 4.3.18-1 lists the different types of identified traffic and rail accidents.

TABLE 4.3.18-1 IDENTIFIED TYPES OF TRAFFIC AND RAIL ACCIDENTS (PENNDOT, 2019A; FRA, 2021).

Mode	Type of Accident	Description
Traffic	Non-collision	A harmful event that does not involve a collision, such as a fire, explosion, or overturn.
	Angle	A crash in which two vehicles on opposite roadways collide at an intersection, driveway, or ramp.
	Rear-end	A crash in which vehicles traveling in the same direction on the same road collide.
	Head-on	A crash in which vehicles traveling in opposite directions, on the same road collide.

Mode	Type of Accident	Description
	Sideswipe	A crash between two vehicles in which the sides of the vehicles engage.
	Hit fixed object	A collision in which a vehicle hits a stationary object on or adjacent to the roadway.
	Hit pedestrian	A collision between a motor vehicle and any person not in or upon the vehicle.
Rail	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.

Figure 4.3.18-1 shows the major highways, rail lines, and airports located throughout Carbon County. Within Carbon County, there are 26.9 miles of turnpike, 364.13 miles of state and federal highway, 402.38 miles of secondary and municipal roads, 70 miles of rail line, and 166 bridges in the County (PennDOT, 2019b; PennDOT, 2021). The major transportation networks most important for the movement of goods and people in Carbon County include Interstates 476 and 80, US Route 209, State Routes 54, 93, 248, 443, 534, 895, 902, 903, and 940. Figure 4.3.18-2 illustrates the average annual daily traffic for Carbon County major roads.

There are also several railroads that operate in the County, many of which that transport freight of all types including hazardous materials through the County. The Reading Blue Mountain and Northern Railroad Company operates a line along the Lehigh Gorge and provides passenger service through Lehigh Gorge Scenic Railway passenger train rides. The Norfolk Southern Railway Company also operates a line that runs through the County from Weatherly Borough, along the Lehigh River to Palmerton. The Chestnut Ridge Railway Company runs a private railway line that begins in Palmerton. The Carbon County Railroad Commission also oversees a short railroad line, the C&S Railroad, which services local industries (Carbon County, 2013). There is potential for major accidents on any of these railways.

Carbon County has two small airports: the Carbon County Airport Authority (Jake Arner Memorial Airport) located in Mahoning Township and the privately owned Beltzville Airport located in Franklin Township. Since the 2010 HMP, the privately owned Neeb Airport in Franklin Township has closed. It is displayed in Table 2.5-1 and Figure 4.3.16-3, as the County still maintains this infrastructure in its land use data. Additionally, there are private airfields in East Penn Township, Lower Towamensing Township, Packer Township, and Lehigh Township. There is a heliport at the Gnaden Huetten Hospital in Lehighton Borough as well as additional heliports in Lehigh Township, Lehighton Borough, and Penn Forest Township (Carbon County, 2013).

There are three pipelines that run through Carbon County: a gas transmission pipeline which runs east-west through the northern part of the county and two hazardous liquid pipelines which run north-south through the eastern part of the county (see Figure 4.3.18-3). In addition to these established routes, a new pipeline has been proposed which would transect Carbon County. The 105-mile PennEast pipeline would originate in Luzerne County, passing through Carbon, Northampton, and Bucks Counties in Pennsylvania and Hunterdon and Mercer

Counties in New Jersey. As illustrated in maps released by Carbon County (Figure 4.3.18-4), the proposed route of the pipeline would run north to south entering the County in Kidder Township and passing through Penn Forest, Towamensing, and Lower Towamensing Townships (CCAP, 2017).

There are increasingly large numbers of chemicals, oils, radioactive materials, and other hazardous substances spilled as a result of highway, rail, and waterway accidents, storage tank leakage, pipeline break, and/or other accidents. Such releases can affect the nearby population and contaminate critical or sensitive environmental areas. On occasion, these events become a major disaster and force people to evacuate and/or lose their homes and businesses. According to the U.S. DOT's Office of Operations and the U.S. Census Bureau, it is estimated that 11 percent of all freight transported by trucks is hazardous material.

The Northeastern Pennsylvania Alliance (NEPA) maintains the Long-Range Transportation Plan (LRTP) for a four-county region: Schuylkill, Carbon, Monroe, and Pike. The LRTP contains a commodity flow study overview for the region. In 2011, the four-county region annually generated approximately 18 million tons of freight, which is projected to increase to 32 million tons by 2040. Interstate 81 and Interstate 80 are expected to experience the largest increases in tonnage by 2040. The region's top exported commodity by tonnage is anthracite coal, followed closely by concrete products. The top imported commodities are petroleum refining products, field crops, broken stone or rip rap, and gravel and sand. Commodities in the region are moved within and in/out of the region primarily by truck, with rail transports moving only about 5% of commodities (NEPA, 2020).

Several railroad accidents have occurred in Pennsylvania involving hazardous materials, though none in Carbon County (NTSB, 2021). Potential also exists for hazardous material release incidents to occur along pipelines. Large spills can result from collisions or derailments of train cars. Pipelines that transport hazardous liquids and flammable substances can corrode, be damaged during excavation, incorrectly operated, or damaged by other natural or human-made forces leading to a hazardous materials release incident.

FIGURE 4.3.18-1 CARBON COUNTY TRANSPORTATION INFRASTRUCTURE

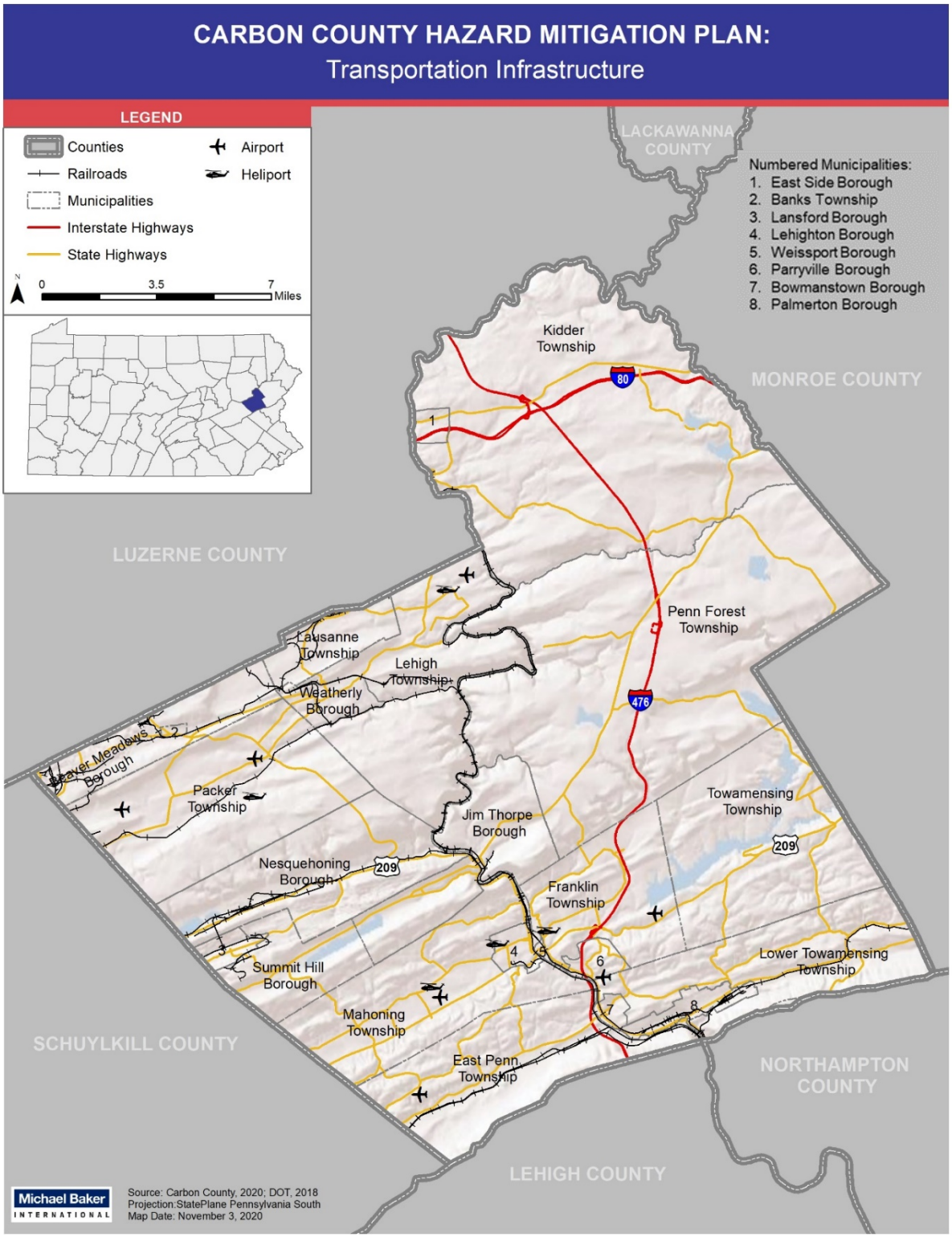


FIGURE 4.3.18-2 DAILY TRAFFIC VOLUME ON MAJOR ROADWAYS IN CARBON COUNTY

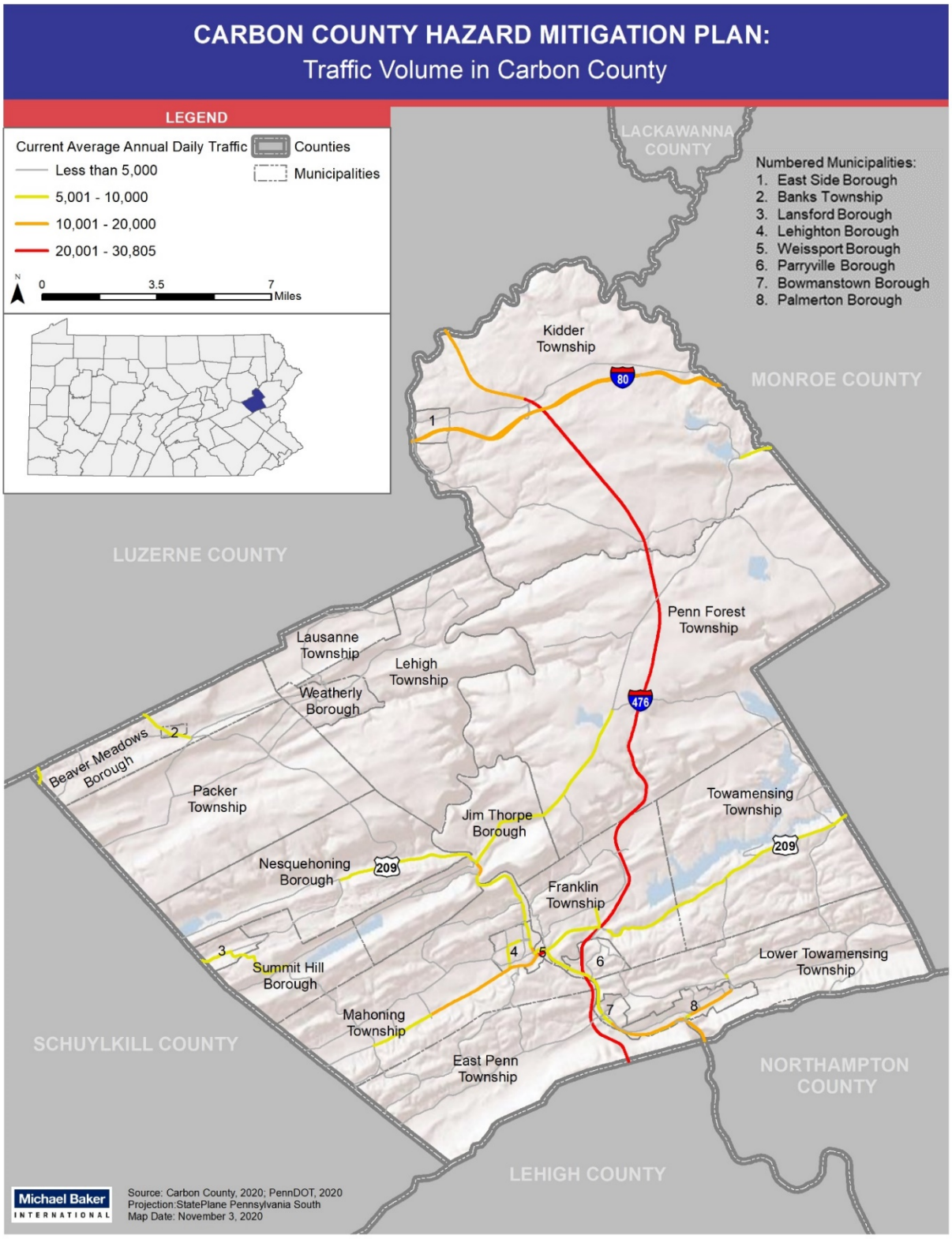


FIGURE 4.3.18-3 TRAFFIC ACCIDENT HOT SPOTS IN CARBON COUNTY

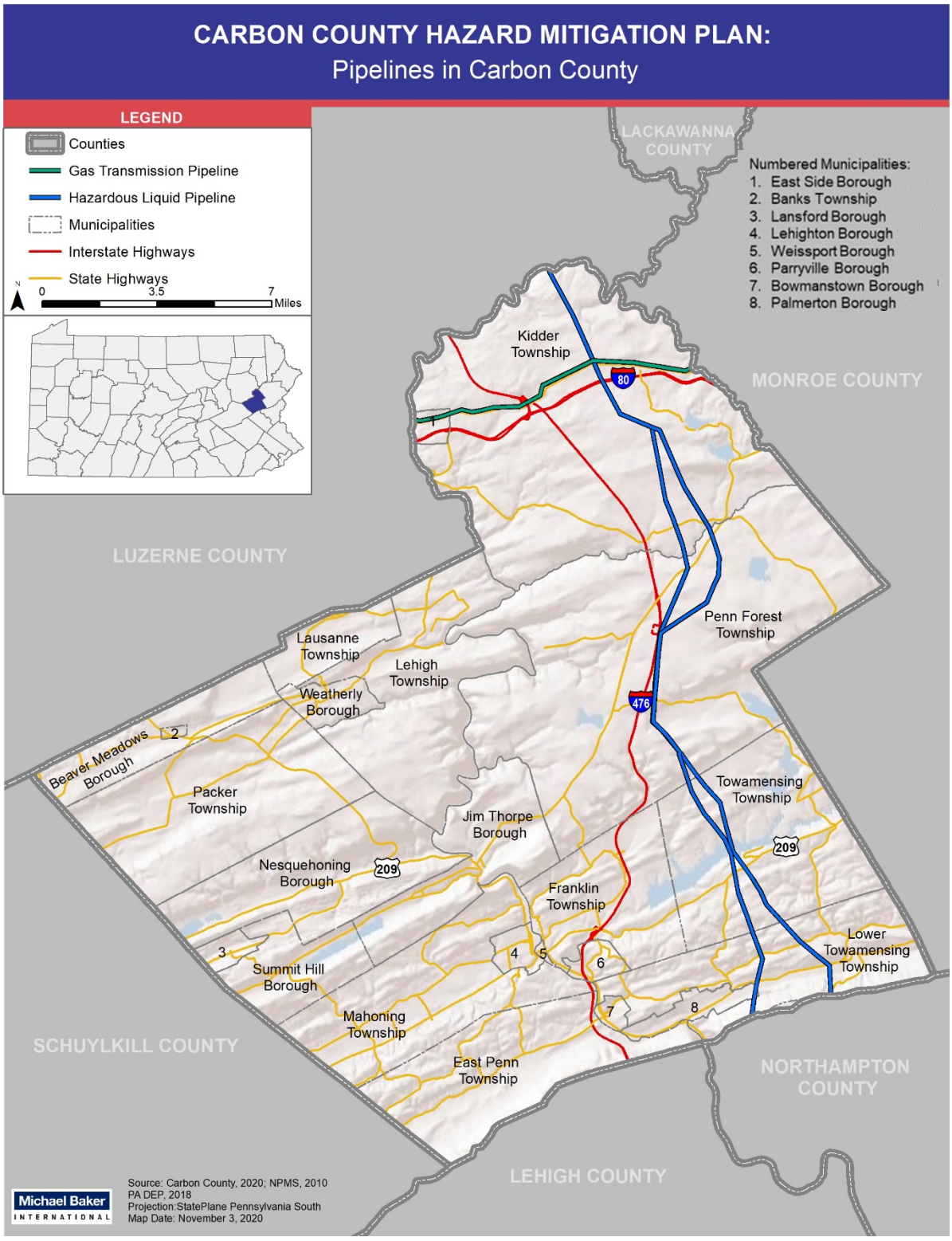
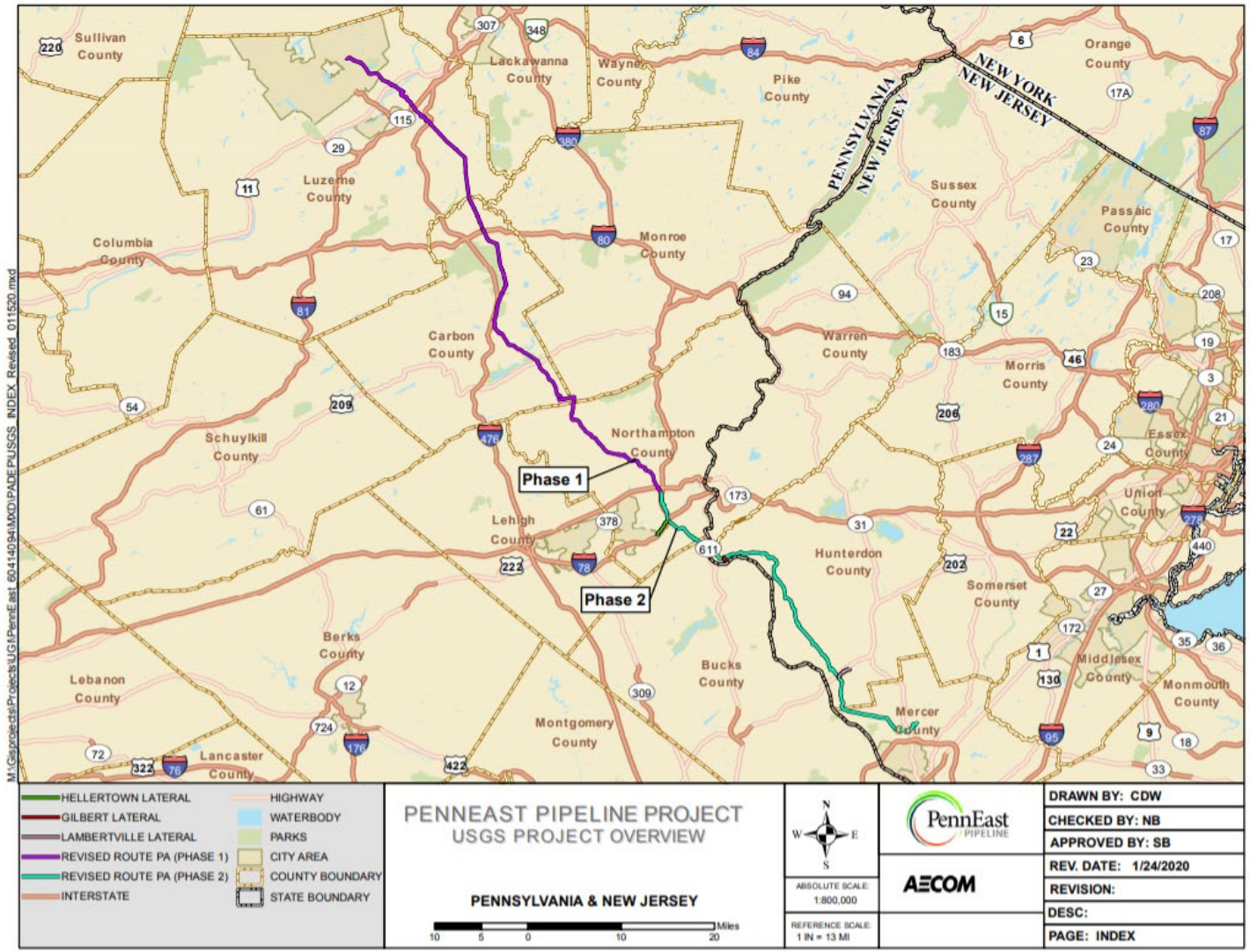


FIGURE 4.3.18-4 PROPOSED PENNEAST PIPELINE (PENNEAST, 2021)



4.3.18.2. Range of Magnitude

Transportation accidents can result in damage to the vehicles and minor injuries to passengers and drivers. Significant transportation accidents can result in death or serious injury or extensive property loss or damage coupled with business interruptions and hours of congestion. Roads and railway accidents in particular have the potential to result in hazardous materials releases if the vehicle involved in an accident is hauling hazardous materials. The expected impacts of transportation accidents are amplified by the fact that there is often little warning of accidents.

Hazardous material releases related to transportation accidents can contaminate air, water, and soils, resulting in property damage, injuries, and death. Dispersion can take place rapidly when transported by water and wind. Response time and quantity and type of material release also impact the severity of an accident. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas. The HMSC identified that there is an increased risk to exacerbate fires if there is a gas or hazardous material release near an existing wildfire. Areas like Towamensing Township where two pipelines run through large areas of state forests are particularly vulnerable to that scenario.

A worst-case scenario for transportation accidents occurred in the County on November 21, 1999 when four buses carrying Penn State students crashed on Interstate 80 in Kidder Township. Over 200 passengers were involved in the accident which resulted in 113 injuries and 2 fatalities (Ramirez, 1999).

4.3.18.3. Past Occurrence

The most common transportation accidents in the County are highway incidents involving motor vehicles. However, vehicle crashes are a risk throughout the County. Table 4.3.18-2 below summarizes vehicular crash data from 2004-2019 for Carbon County. The most recent available Crash Facts and Statistics report was published in 2020, covering 2019 data.

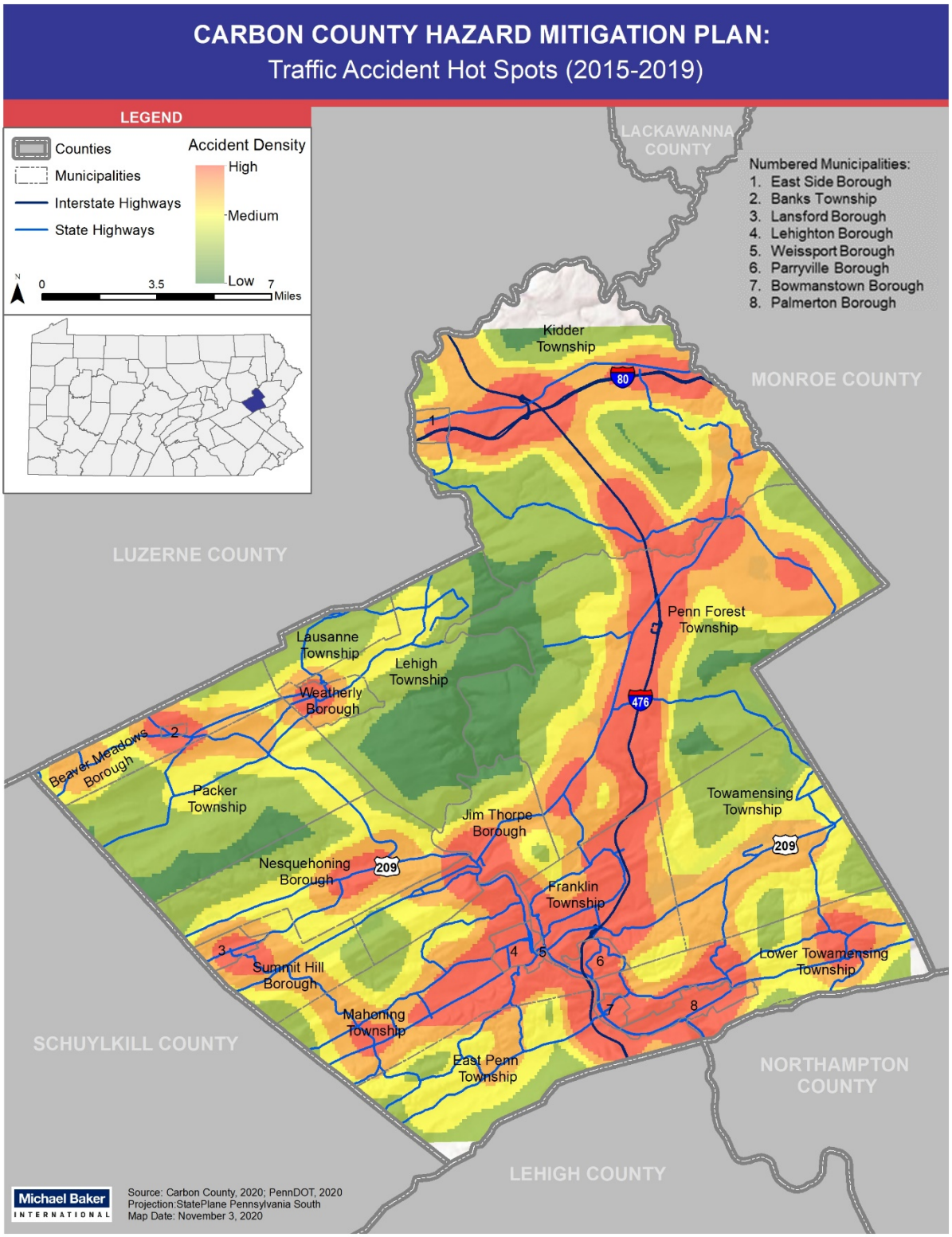
TABLE 4.3.18-2 REPORTABLE TRAFFIC CRASH DATA (2004-2019) (PENNDOT, 2019A).

YEAR	REPORTABLE CRASHES	# FATAL CRASHES	# PERSONS KILLED	# INJURY CRASHES
2004	758	12	13	374
2005	795	13	14	419
2006	763	14	17	395
2007	731	12	13	347
2008	704	14	16	315
2009	660	11	11	312
2010	744	12	13	328
2011	712	8	8	351
2012	702	6	6	329
2013	722	15	16	319
2014	690	6	10	278
2015	735	9	11	308
2016	705	10	12	272
2017	745	9	9	309

YEAR	REPORTABLE CRASHES	# FATAL CRASHES	# PERSONS KILLED	# INJURY CRASHES
2018	749	12	13	274
2019	748	7	7	273
TOTAL	11,663	170	189	5,203

Figure 4.3.18-5 shows the density of transportation crashes throughout Carbon County. Red and yellow areas show roadways where the most crashes occurred between 2015 and 2019. This map is a visualization of the table above, utilizing the most recent data available through PennDOT. The County's most serious transportation concerns involve Interstates 476 and 80 which have the highest average annual daily traffic. Crashes are also densely concentrated around the more populated communities in the southern portion of the County, including Palmerton Borough, as well as around Jim Thorpe Borough in the center of the County.

FIGURE 4.3.18-5 TRAFFIC ACCIDENT HOT SPOTS IN CARBON COUNTY



Transportation-related hazardous material release incidents are tracked by the federal government. The U.S. Department of Transportation Pipeline and Hazardous Materials Safety

Administration (PHMSA) maintains information on hazardous material releases by highway, freight, air, rail, and pipeline incidents. Table 4.3.18-3 shows the amount of reported hazardous material release incidents by municipality in Carbon County between 1972 and 2020. Two incidents resulted in serious bulk release of a HAZMAT, one caused a serious evacuation, one led to HAZMAT related injuries, and two closed major arterial roads. No incidents resulted in fatalities or radioactive releases. 22 of these events resulted in spills, three led to vapor gas dispersion, one caused environmental damage, and one caused a fire.

TABLE 4.3.18-3 TRANSPORTATION RELATED HAZARDOUS MATERIAL RELEASES IN CARBON COUNTY, 1972 – 2020 (PHMSA, 2021).

MUNICIPALITY	HIGHWAY RELEASES	RAIL RELEASES	TOTAL
Bowmanstown Borough	1	0	1
Franklin Township	1	0	1
Kidder Township	1	0	1
Lehighton Borough	12	2	14
Nesquehoning Borough	3	0	3
Palmerton Borough	2	1	3
Parryville Borough	1	0	1
TOTAL	21	3	24

4.3.18.4. Future Occurrence

The County's population has increased slightly over the last decade so it can be assumed that local traffic has increased slightly as well. Additionally, the trucking industry is expected to continue to grow increasing the number of long-haul trucks operating in the County on a daily basis. While hazardous material release incidents through transportation accidents have occurred in Carbon County in the past, they are generally considered difficult to predict. The expected increases in transportation related responses requires specialized training and equipment to be maintained at a high level of preparedness. Based on this and past occurrences, the future occurrence of transportation accidents Carbon County can be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.18.5. Vulnerability Assessment

A transportation related accident can occur on any stretch of road or railway in Carbon County. However, severe accidents are more likely along roadways that experience heavier traffic volumes including heavy freight vehicles. The combination of high traffic volume, severe winter weather in the County, and large numbers of hazardous materials haulers increase the chances of traffic accidents occurring.

According to the 2009 Carbon County Hazard Vulnerability Assessment, major highways in Carbon County where accidents are most likely to occur are:

- Interstates:
  - 476 – Northeast Extension of the PA Turnpike; the HMSC identified that transportation accidents are especially likely along the Turnpike in Franklin Township
  - 80 – Kidder Township

- State Routes:
    - 93 – Nesquehoning, Packer Township, Beaver Meadows, Banks Township
    - 209 – Passes through the entire County
    - 902 – Mahoning Township, Summit Hill
    - 903 – Jim Thorpe, Kidder, Penn Forest
    - 443 – Lehighton, Mahoning Township
    - 248 – Franklin Township, Parryville, Bowmanstown, Palmerton
    - 895 – East Penn Township

Like highway incidents, rail incidents can impact populations living near rail lines. Crude oil shipping across the United States has grown by a factor of seventeen in the last five years, increasing the risk for a derailment or rail accident to involve this material. Additionally, recent rail incidents from 2013 to 2015 have shown a high risk for trains carrying crude oil to explode upon derailment (FracTracker, 2015). In 2015, the HMSC identified the areas of rail in Penn Forest and Lehigh Townships as being especially vulnerable to rail incidents, including in the areas around Penn Haven Junction and tunnels.

Carbon County is also susceptible to airplane accidents due to the proximity of several International Airports. Carbon County is in the Air Traffic Patterns for landing approaches and take-offs for Lehigh Valley, Wilkes Barre/Scranton and Newark International Airports (CCEMA, 2009). The average rate of aviation accidents nation-wide is 8.47 accidents per 100,000 flight hours. Therefore, the likelihood of a serious aviation incident in the County is considered low.

Because of the widespread transportation network in Carbon County, a large number of structures are exposed to the threat of transportation accidents. Utilizing Census Block data and proximity to modes of transportation, Tables 4.3.18-5 and 4.3.18-6 identify the structures and critical facilities within a half-mile of a major highways and rail lines, within a 5-mile buffer of an airport, and within a quarter-mile buffer of a pipeline. The half-mile buffer represents the recommended evacuation zone around a highway or rail line in the event of a hazardous material release in transit, the 5-mile buffer represents the area where aviation accidents typically occur, and the quarter-mile buffer represents the area typically affected by a pipeline rupture.

TABLE 4.3.18-5 STRUCTURES VULNERABLE TO TRANSPORTATION INCIDENTS.

Municipality	Total Structures	Structures in Road Accident Area	% Structures in Road Accident Area	Structures in Rail Accident Area	% Structures in Rail Accident Area	Structures in Pipeline Accident Area	% Structures in Pipeline Accident Area	Structures in Air Accident Area	% Structures in Pipeline Accident Area
Banks Township	655	655	100%	655	100%	0	0%	655	100%
Beaver Meadows Borough	441	441	100%	441	100%	0	0%	441	100%
Bowmanstown Borough	428	428	100%	342	79.9%	0	0%	428	100%
East Penn Township	1,552	1,181	76.1%	922	59.4%	0	0%	1,552	100%
East Side Borough	322	322	100%	84	26.1%	276	85.7%	237	73.6%
Franklin Township	2,207	1,942	88.0%	521	23.6%	0	0%	2,207	100%
Jim Thorpe Borough	2,473	2,242	90.7%	1,825	73.8%	0	0%	2,473	100%
Kidder Township	3,736	2,709	72.5%	70	1.9%	560	15.0%	201	5.4%
Lansford Borough	2,096	2,096	100%	2,096	100%	0	0%	1,589	75.8%
Lausanne Township	132	126	95.5%	115	87.1%	0	0%	132	100%
Lehigh Township	289	262	90.7%	87	30.1%	0	0%	287	99.3%
Lehighton Borough	2,383	2,383	100%	1,958	82.2%	0	0%	2,383	100%
Lower Towamensing Township	1,540	1,385	89.9%	673	43.7%	181	11.8%	1,055	68.5%
Mahoning Township	1,989	1,669	83.9%	320	16.1%	0	0%	1,989	100%
Nesquehoning Borough	1,646	1,586	96.4%	1,628	98.9%	0	0%	1,646	100%
Packer Township	512	405	79.1%	264	51.6%	0	0%	512	100%
Palmerton Borough	2,328	2,333	100%	2,313	99.4%	0	0%	2,333	100%
Parryville Borough	311	311	100%	217	69.8%	0	0%	311	100%
Penn Forest Township	7,200	2,867	39.8%	9	0.1%	592	8.2%	607	8.4%
Summit Hill Borough	1,496	1,477	98.7%	1,312	87.7%	0	0%	443	29.6%

Municipality	Total Structures	Structures in Road Accident Area	% Structures in Road Accident Area	Structures in Rail Accident Area	% Structures in Rail Accident Area	Structures in Pipeline Accident Area	% Structures in Pipeline Accident Area	Structures in Air Accident Area	% Structures in Pipeline Accident Area
Towamensing Township	1,980	1,133	57.2%	0	0%	352	17.8%	1,374	69.4%
Weatherly Borough	1,009	1,003	99.4%	996	98.7%	0	0%	1,009	100%
Weissport Borough	173	173	100%	173	100%	0	0%	173	100%
Grand Total	**36,898**	**29,129**	**78.9%**	**17,021**	**46.1%**	**1,961**	**5.3%**	**24,037**	**65.1%**

TABLE 4.3.18-6 CRITICAL FACILITIES VULNERABLE TO TRANSPORTATION INCIDENTS.

Municipality	Total Critical Facilities	Critical Facilities in Road Accident Area	% Critical Facilities in Road Accident Area	Critical Facilities in Rail Accident Area	% Critical Facilities in Rail Accident Area	Critical Facilities in Pipeline Accident Area	% Critical Facilities in Pipeline Accident Area	Structures in Air Accident Area	% Structures in Pipeline Accident Area
Banks Township	8	8	100%	8	100%	0	0%	8	100%
Beaver Meadows Borough	2	2	100%	2	100%	0	0%	2	100%
Bowmanstown Borough	4	4	100%	4	100%	0	0%	4	100%
East Penn Township	10	4	40.0%	6	60.0%	0	0%	10	100%
East Side Borough	1	1	100%	1	100%	1	100%	1	100%
Franklin Township	13	11	84.6%	0	0%	0	0%	13	100%
Jim Thorpe Borough	25	24	96.0%	15	60.0%	0	0%	25	100%
Kidder Township	36	27	75.0%	1	2.8%	1	2.8%	13	36.1%
Lansford Borough	5	5	100%	5	100%	0	0%	5	100%
Lausanne Township	3	1	33.3%	1	33.3%	0	0%	3	100%
Lehigh Township	7	6	85.7%	3	42.9%	0	0%	7	100%
Lehighton Borough	12	12	100%	8	66.7%	0	0%	12	100%
Lower Towamensing Township	8	8	100%	3	37.5%	0	0%	6	75.0%
Mahoning Township	11	11	100%	1	9.1%	0	0%	11	100%
Nesquehoning Borough	17	15	88.2%	15	88.2%	0	0%	17	100%
Packer Township	5	3	60.0%	3	60.0%	0	0%	5	100%
Palmerton Borough	13	13	100%	12	92.3%	0	0%	13	100%
Parryville Borough	4	4	100%	4	100%	0	0%	4	100%
Penn Forest Township	21	15	71.4%	0	0%	2	9.5%	2	9.5%
Summit Hill Borough	8	8	100%	5	62.5%	0	0%	4	50.0%
Towamensing Township	20	15	75.0%	0	0%	2	10.0%	15	75.0%
Weatherly Borough	7	7	100%	7	100%	0	0%	7	100%
Weissport Borough	3	3	100%	3	100%	0	0%	3	100%
Grand Total	**243**	**207**	**85.2%**	**107**	**44.0%**	**6**	**2.5%**	**190**	**78.2%**

4.3.19. Utility Interruption

4.3.19.1. Location and Extent

Utility interruptions include any impairment of the functioning of telecommunication, gas, electric, water, or waste networks. Interruptions or outages occur because of geomagnetic storms, fuel or resources shortage, electromagnetic pulses, information technology failures, transmission facility or linear utility accident, and major energy, power, or utility failure. The focus of utility interruptions as a hazard lies primarily in power failures. These kinds of interruptions rarely spontaneously occur on their own; this hazard is often secondary to other hazard events, particularly transportation crashes and incidents, lightning strikes, extreme heat or cold events, and coastal and winter storms. Severe storms can down power lines and cause widespread disruptions. Strong heat waves may result in rolling blackouts where power may not be available for an extended period of time. Local outages may be caused by traffic accidents or wind damage. Utility interruptions can take place throughout the County.

Utility interruptions in Carbon County occur regularly but are usually small-scale, localized incidents. Utility interruptions are possible anywhere there is utility service. Table 4.3.9-1 lists the major Carbon area utility companies. Water authorities are listed and discussed in Section 4.3.1. Electric and gas services in Carbon County are primarily provided by Pennsylvania Power & Light (PPL).

TABLE 4.3.19 -1 MAJOR UTILITY COMPANIES IN CARBON COUNTY (CARBON COUNTY, 2021C)

COMPANY NAME	UTILITY TYPE
Pennsylvania Power and Light	Electric and Gas
Atlantic Oil & Heating Company	Petroleum or Gas
Boyko Petroleum Service Inc.	
LehighFuels	
UGI Utilities, Inc.	
Alltel Pennsylvania Inc.	Telecom
Blue Ridge Cable Television Inc.	
CenturyLink	
MCI Telecommunications Corporation	
Palmerton Telephone Company	
Panther Creek Power Operating LLC	
Service Electric Cable TV	
Verizon	

According to the 2019 5-year American Community Survey, in Carbon County, 47.3% of housing units use fuel oil as their heat source, followed by 26.5% of homes using electric heat and 10.5% using utility gas (US Census, 2019). As a result, an interruption in these utilities could affect a significant number of residents, especially during the winter. In addition, an increasing reliance on internet access and telecommunications could also a large number of residents at any given time.

4.3.19.2. Range of Magnitude

The most severe utility interruptions are regional or widespread power and telecommunications outages. With the loss of power, electrical powered equipment and

systems will not be operational. Examples may include: lighting; HVAC and ancillary support equipment; communication (i.e. public address systems, telephone, computer servers, and peripherals); ventilation systems; fire and security systems; refrigerators, sterilizers, trash compactors, office equipment; and medical equipment. This can cause food spoilage, loss of heat or air conditioning, basement flooding (sump pump failure), lack of light, loss of water (well pump failure), lack of phone service, or lack of internet service. However, this is most often a short-term nuisance rather than a catastrophic hazard.

The severity of a utility interruption can be compounded with extreme weather events, especially winter weather events. Interruptions can also be more severe for special needs populations that are dependent on electronic medical equipment. Utility interruptions can significantly hamper first responders in their efforts to provide aid in a compound disaster situation, especially with losses of telecommunications and wireless capabilities. Telecommunications interruptions will also hinder first responders' efforts. Additionally, an internet outage could be crippling to the economy, as many companies and government entities conduct activities virtually.

A worst-case scenario for utility interruption in Carbon County occurred during the winter ice storm of 2005. Downed trees and wires from the heavy ice formation caused power outages throughout the entire County for prolonged periods of time and in some municipalities the power was out for over a week (CCEMA, 2009). These types of scenarios cause widespread power outages, leaving citizens without heat in the midst of subzero temperatures. Power lines are unable to be repaired for prolonged periods because of the magnitude of the storm.

4.3.19.3. Past Occurrence

Utility interruptions are largely minor, routine events. In Carbon County minor power outages occur annually, about four or five times per year. They are most often associated with winter storms and windstorms. No complete/comprehensive list of utility interruptions exists for the county.

4.3.19.4. Future Occurrence

Utility interruptions will continue to occur annually with minimal impact. Widespread utility interruption events usually occur approximately once every five years, usually as a secondary effect of an extreme weather event. These interruptions should be anticipated, and first responders should be prepared during severe weather events. Research by the National Oceanic and Atmospheric Administration (NOAA) suggests that climate change may cause more extreme storms in Pennsylvania (Frankson et al., 2017).

Carbon County is expected to see large increases in precipitation and numbers of very hot and very cold days (Climate Central, 2019). These factors can increase the occurrence of hazards such as flooding, hurricanes and tropical storms, landslides, tornados and windstorms, wildfires, and winter storms. Impacts from any of these hazards can lead to utility interruption on a range of scales. Overall, the future occurrence of utility interruptions in Carbon County can be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

Aging infrastructure also brings risk in the form of potential utility interruptions, particularly for places like Carbon County with aging infrastructure. In many utility systems, significant portions of equipment and facilities date from the growth periods of the 1950s and 1960s that followed World War II. As this equipment ages, it deteriorates from the constant wear and tear of services. Eventually the equipment reaches a point at which it will either fail on its own or as

a result of outside forces (storms, loads it was designed to handle but no longer can, etc.). These failures cause service interruptions and can require expensive emergency repairs. In addition, as repairs have taken place along transmission routes, there is often a mix of new and old equipment along the line, as repair and not replacements is generally the choice made to resolve an issue.

The wholesale replacement of a system is not a feasible solution for utility companies. This would require the interruption of services while the replacement occurs, as well as accessing the existing system (which may lay under roads, private property, or other inconvenient places). Utility companies face the challenge of managing the issue of the aging infrastructure. They are tasked with reducing the effects of aging equipment while also controlling the deterioration of the existing system as much as possible. This balance will be tenuous as transmission equipment continues to age and break down. These breakdowns will likely lead to more frequent utility disruptions as time goes by.

4.3.19.5. Vulnerability Assessment

All jurisdictions are vulnerable on some level to utility interruptions, but because this hazard often occurs in conjunction with other hazards, jurisdictions that have been identified as more vulnerable to winter storms, flooding, and other natural hazard events may be more vulnerable to a utility interruption.

Utility outages pose the greatest threat to special needs populations in Carbon County. Resources such as electricity, communications, gas, and water supply are critical to ensure the health, safety, and general welfare of the citizenry. All critical infrastructure is vulnerable to the effects of a power outage. Emergency medical facilities as well as retirement homes and senior centers are particularly vulnerable to power outages. While back-up power generators are often used at these facilities, loss of electricity may result in hot or cold temperatures for which populations in these facilities are particularly vulnerable.

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 planning area. The RF can also be used to assist local community officials in ranking and prioritizing those hazards that pose the most significant threat to their 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, and 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 19 hazards profiled in the 2021 HMP Update. Those categories include *probability*, *impact*, 1*spatial extent*, *warning time,* and *duration*. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor is shown in Table 4.4-1. 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 example equation:

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

Table 4.4-1 summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

TABLE 4.4-1 SUMMARY OF RISK FACTOR APPROACH USED TO RANK HAZARD RISK

Risk Assessment Category	Degree of Risk			Weight Value
	Level	Criteria	Index	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1% & 49.9% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 50% & 90% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	GREATER THAN 90% ANNUAL PROBABILTY	4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.	3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.	4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10.9% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 11 & 25% OF AREA AFFECTED	3	
	LARGE	GREATER THAN 25% OF AREA AFFECTED	4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	MORE THAN 24 HRS	SELF-DEFINED	1	10%
	12 TO 24 HRS	SELF-DEFINED	2	
	6 TO 12 HRS	SELF-DEFINED	3	
	LESS THAN 6 HRS	SELF-DEFINED	4	
DURATION *How long does the hazard event usually last?*	LESS THAN 6 HRS	SELF-DEFINED	1	10%
	LESS THAN 24 HRS	SELF-DEFINED	2	
	LESS THAN 1 WEEK	SELF-DEFINED	3	
	MORE THAN 1 WEEK	SELF-DEFINED	4	

(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)

(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4-2 lists the Risk Factor calculated for each of the 19 hazards identified in the 2021 HMP Update. Hazards identified as *high* risk have risk factors of 2.5. or greater. 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 4.4-2 RANKING OF HAZARD TYPES BASED ON RISK FACTOR METHODOLOGY.

HAZARD RISK	HAZARD NATURAL (N) OR HUMAN-MADE (M)	RISK ASSESSMENT CATEGORY					RISK FACTOR
		PROBABILITY (1-4)	IMPACT (1-4)	SPATIAL EXTENT (1-4)	WARNING TIME (1-4)	DURATION (1-4)	
HIGH	Flood, Flash Flood, Ice Jam (N)	4	2	3	3	3	3.0
	Winter Storm (N)	4	2	4	1	3	3.0
	Pandemic & Infectious Disease (N)	3	3	3	1	4	2.6
	Wildfire (N)	4	1	3	4	2	2.5
MODERATE	Disorientation (M)	3	1	1	4	1	2.4
	Utility Interruption (M)	4	1	2	3	2	2.4
	Dam Failure (M)	1	3	2	4	4	2.3
	Nuclear Incident (M)	1	3	2	4	4	2.3
	Transportation Accidents (M)	4	1	1	4	1	2.2
	Drought (N)	2	1	4	1	4	2.2
	Hurricane, Tropical Storm, Nor'easter (N)	2	2	3	1	3	2.1
	Drowning (M)	3	2	2	3	1	2.1
	Levee Failure (M)	1	3	2	3	2	2.1
LOW	Landslide (N)	2	1	2	4	1	1.9
	Hailstorm (N)	2	1	2	3	1	1.7
	Radon Exposure (N)	2	1	2	2	2	1.7
	Environmental Hazards (M)	2	1	1	1	4	1.6
	Building or Structure Collapse (M)	1	1	1	3	1	1.6
	Civil Disturbance	1	1	1	2	1	1.1

Based on these results, there are four *high* risk hazards, nine *moderate* risk hazards and six *low* risk hazards in Carbon County. Mitigation actions were developed for all high, moderate, and low risk hazards (see Section 6.4).

A risk assessment result for the entire county does not mean that each municipality the same risk to each hazard. Municipalities completed a *Hazard Risk Assessment Survey* to during the planning process evaluate their jurisdictional risk to each hazard. Results from these surveys were reassessed by the HMPT, and the update risk assessment was used to complete Table 4.4-3 which shows the different municipalities in Carbon County and whether their risk is greater than (>), less than (<), or equal to (=) the risk factor assigned to the County as a whole.

TABLE 4.4-3 CALCULATED COUNTYWIDE RISK FACTOR BY HAZARD AND COMPARATIVE JURISDICTIONAL RISK

JURISDICTION	Flood (N)	Winter Storm (N)	Pandemic (N)	Wildfire (N)	Disorientation (M)	Utility Interruption (M)	Dam Failure (M)	Nuclear Incident (M)	Transportation Accidents (M)	Drought (N)	Hurricane (N)	Drowning (M)	Levee Failure (M)	Landslide (N)	Hailstorm (N)	Radon Exposure (N)	Environmental Hazards (M)	Building Collapse (M)	Civil Disturbance (H)
	3	3	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.1	2.1	2.1	1.9	1.7	1.7	1.6	1.6	1.1
Banks Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Beaver Meadows Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Bowmanstown Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
East Penn Township	I	NC	NC	NC	NC	NC	NC	NC	NC	NC	I	NC	NC	NC	NC	NC	NC	NC	NC
East Side Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Franklin Township	I	D	NC	NC	I	NC	NC	NC	NC	NC	I	I	NC	NC	NC	NC	NC	I	NC
Jim Thorpe Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Kidder Township	I	I	NC	I	NC	I	NC	NC	I	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lansford Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lausanne Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lehigh Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lehighton Borough	D	I	NC	NC	NC	NC	NC	NC	I	NC	NC	I	NC	NC	NC	NC	NC	NC	NC
Lower Towamensing Township	NC	D	NC	D	NC	I	NC	NC	I	NC	NC	NC	NC	NC	D	NC	NC	D	NC
Mahoning Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nesquehoning Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Packer Township	I	NC	NC	NC	NC	NC	NC	NC	NC	NC	I	NC	NC	NC	NC	NC	NC	NC	NC
Palmerton Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Parryville Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Penn Forest Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Summit Hill Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Towamensing Township	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Weatherly Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	I	NC
Weissport Borough	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

4.4.3. Potential Loss Estimates

Potential loss estimates for hazard events help a community understand the monetary value of what might be at stake during a hazard event. 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.

Loss estimates provided in this section fall into three broad categories: historical losses, current-condition losses, and predictive losses. Historical loss estimates come from three primary sources: the NCDC storm events database, the NFIP, and the USDA's Risk Management Agency annual crop indemnities dating from 1980-2019. Current condition losses come from geospatial analysis of the value of buildings identified as vulnerable in the Vulnerability Assessment section of hazard profiles for floods, landslides, wildfires, dam failure, levee failure, and transportation accidents. Finally, predictive losses were generated using HAZUS, version 2.1. Historical losses do not take into account any of the aforementioned components, but they do provide insight into what future losses might be. The current-condition losses take into account replacement value as well as exposure value. HAZUS modeling takes into account all four components and provides the most comprehensive description of potential losses.

4.4.3.1. Historical Loses

Historical losses were able to be determined for drought, flooding, hailstorms, coastal storms (hurricanes/tropical storms/tropical depressions), and winter storms from NCDC, USDA RMA, and the NFIP.

NCDC reports include property and crop damage estimates with their incident reports. As noted in many of the hazard profiles, though, many of the events have no damages reported. This does not mean that there were no damage; rather, it indicates that no damages were reported to NCDC. As a result, these should be considered low-end estimates of losses. The flood and flash flood events reported in NCDC list $5.11 million in property damage and one fatality over the history of flooding in the county. Hailstorm losses reported to the NCDC totaled over $1 million. Historical losses for winter storms, including ice storms, freezing rain, sleet, and heavy snow, include nine injuries and over $7 million in property damage (NOAA NCEI, 2021).

Agriculture is an integral part of Carbon County's economy, and agricultural production is highly vulnerable to natural hazard events. As previously mentioned, losses are available from the USDA RMA. The RMA operates and manages the Federal Crop Insurance Corporation, which provides crop insurance to American farmers. While not all crops are insured through RMA, their records provide strong insight into agricultural losses nationwide and in Carbon

County. Table 4.4-4 illustrates the total amount of indemnities paid through RMA since 1948 in Carbon County by type of crop failure. Only crop failures related to the hazards discussed in this plan are listed. There has been about $5.1 million in indemnity paid out due to crop loss between 1948 and 2020 in Carbon County. Since 2014, the RMA has paid out $3.2 million in indemnities. The greatest amount of indemnity paid out was due to crop loss from excess moisture, precipitation, or rain, which accounts for about 46-percent of the loss, followed by loss due to drought, which accounted for about 33-percent of the loss.

TABLE 4.4-4 HISTORIC INSURED CROP LOSSES, 1948-2014 (USDA RMA, 2021)

REASON FOR LOSS	INDEMNITY AMOUNT
Cold Wet Weather	$17,125.00
Cold Winter	$46.00
Drought	$1,663,826.00
Excess Moisture/Precipitation/Rain	$2,320,623.40
Fire	$619.00
Flood	$3,260.00
Freeze	$344,983.60
Hail	$512,567.10
Hurricane/Tropical Depression	$51,571.00
Wind/Excess Wind	$3,589.00
Other	$155,362.40
Total	$5,073,880.10

The final set of historic losses relates solely to prior flood losses and comes from the NFIP's records of claims paid. Table 4.4-5 shows the total amount of claims paid in each municipality according to CIS. There has been just over $400,000 paid to all municipalities in Carbon County; over half of which was paid to a total of 42 claims in Palmerton Borough.

TABLE 4.4-5 CARBON COUNTY HISTORIC FLOOD LOSSES (FEMA CIS, 2021B)

COMMUNITY	STATUS	TOTAL AMOUNT OF PAID CLAIMS
Banks Township	Participating	$0
Beaver Meadows Borough	Participating	$0
Bowmanstown Borough	Participating	$8,355
East Penn Township	Participating	$27,213
East Side Borough	Participating	$0
Franklin Township	Participating	$7,334
Jim Thorpe Borough	Participating	$0
Kidder Township	Participating	$11,203
Lansford Borough	Participating	$0
Lausanne Township	Participating	$0
Lehigh Township	Participating	$0
Lehighton Borough	Participating	$3,672
Lower Towamensing Township	Participating	$21,227
Mahoning Township	Participating	$21,993
Nesquehoning Borough	Participating	$29,230
Packer Township	Participating	$27,094
Palmerton Borough	Participating	$213,225
Parryville Borough	Participating	$0
Penn Forest Township	Participating	$21,134
Summit Hill Borough	Participating	$0
Towamensing Township	Participating	$0
Weatherly Borough	Participating	$0
Weissport Borough	Participating	$7,761
TOTAL		$406,557

Current Condition Losses

The current conditions were assessed using the analysis completed by FEMA for the RiskMAP program to estimate the Total Exposure in Floodplain (TEIF). This analysis was completed to help provide communities additional information about the relative comparison in their communities of potential flood loss (FEMA, 2015). The analysis uses the Census Tract Total Exposure Dollar Values from the 2010 Census and calculates the intersection of the census tracts with the SFHA. This calculation also uses dasymmetric census blocks using this information to better attribute areas of population geographically within the block.

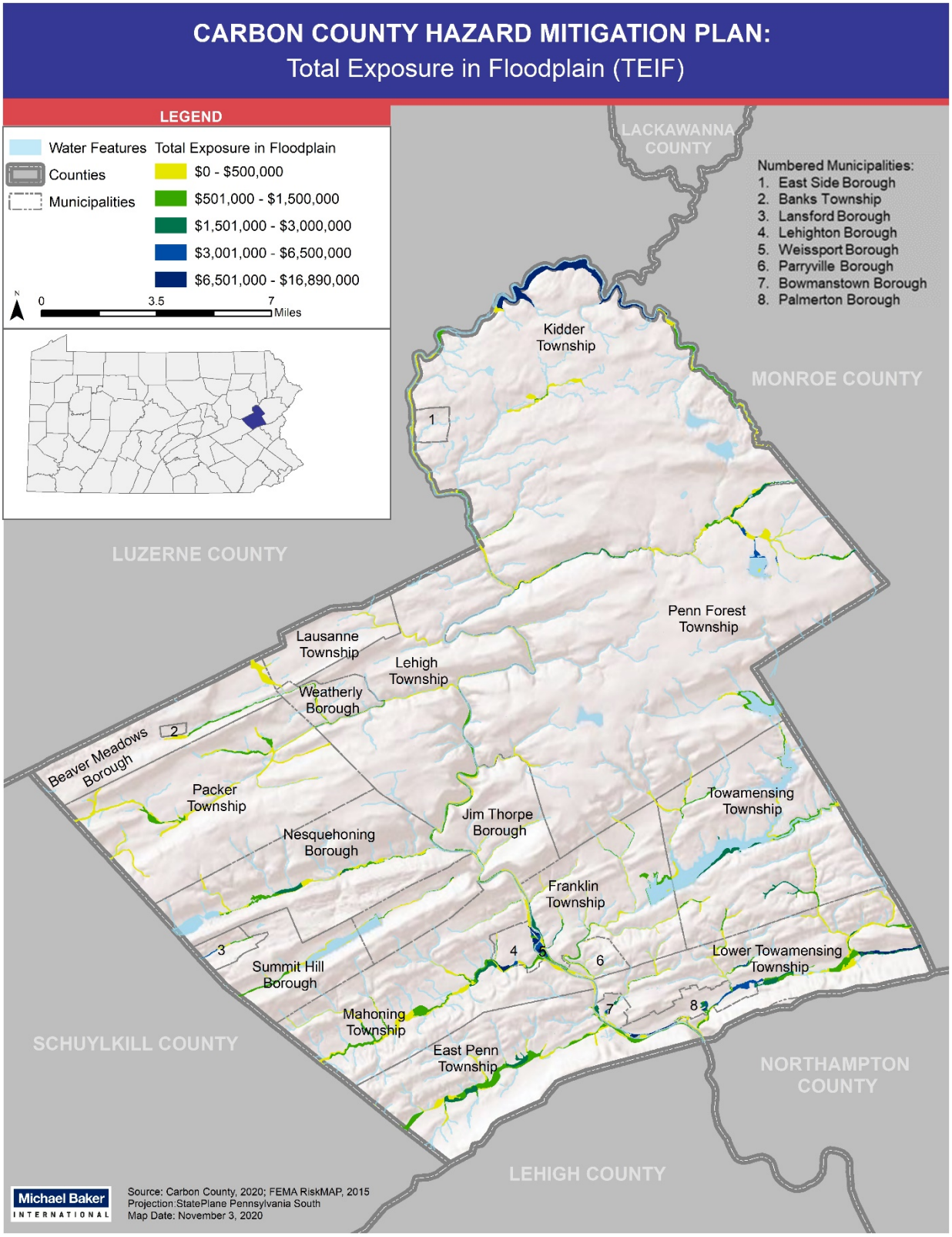
The results of the TEIF calculation are detailed in Table 4.4-7 and illustrated in Figure 4.4-1. In addition to the TEIF calculation, Table 4.4-7 includes the ranking of the municipalities with a calculated TEIF over 0 compared to all other municipalities in Pennsylvania. This ranking provides context to the relative exposure of Carbon County municipalities as compared to

other municipalities in Pennsylvania; the highest ranked municipality is Palmerton Borough, which has the 166th highest exposure of the 2,562 municipalities in Pennsylvania.

TABLE 4.4-7 CARBON COUNTY TOTAL EXPOSURE IN FLOODPLAIN (FEMA, 2015)

MUNICIPALITY	TOTAL EXPOSURE IN FLOODPLAIN	PENNSYLVANIA TEIF RANKING
Banks Township	$1,768,004	2,243
Beaver Meadows Borough	$0	NA
Bowmanstown Borough	$17,121,989	994
East Penn Township	$24,011,220	775
East Side Borough	$551,542	2,379
Franklin Township	$21,528,704	828
Jim Thorpe Borough	$11,320,969	1,324
Kidder Township	$18,824,947	907
Lansford Borough	$6,106,843	1,742
Lausanne Township	$384,536	2,401
Lehigh Township	$2,558,959	2,142
Lehighton Borough	$61,461,922	312
Lower Towamensing Township	$47,089,785	422
Mahoning Township	$22,185,428	815
Nesquehoning Borough	$14,917,530	1,108
Packer Township	$7,385,739	1,614
Palmerton Borough	$97,670,453	166
Parryville Borough	$4,258,532	1,935
Penn Forest Township	$22,823,671	804
Summit Hill Borough	$1,630,204	2,256
Towamensing Township	$18,757,153	910
Weatherly Borough	$6,023,928	1,752
Weissport Borough	$47,716,929	417
TOTAL	$456,098,987	NA

FIGURE 4.4-1 TOTAL EXPOSURE IN FLOODPLAIN IN CARBON COUNTY (FEMA, 2015)



4.4.3.2. Predictive Losses

This plan employed an enhanced HAZUS analysis for floods. As opposed to basic analysis using only default data, enhanced analysis incorporates both up-to-date and specific data for inclusion in the hazard models. The enhanced data incorporated into this HMP update include:

- Updated demographic data from the 2010 Census,
- Updated essential facilities data from the County
- Dasymetric Census blocks to better attribute areas of population geographically within the block, and
- A user-delineated 100-year depth grid derived for Carbon County from the effective FIRM data.

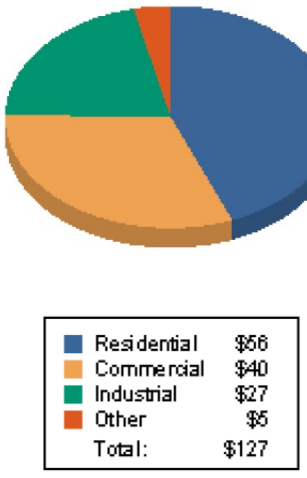
For more details on the HAZUS methodology used and additional results reports, see Appendix F – HAZUS Reports.

Using these datasets, total economic losses from a 1-percent-annual-chance flood in Carbon County are estimated at $126.90 million, nearly all of which is attributed to building loss. Figure 4.4-2 shows the distribution of economic loss estimates by occupancy type. Residential occupancies make up 77.6 percent of the total estimated building-related losses, commercial buildings make up a further 12.9 percent, and industrial make up the remaining largest percentage with 5.4 percent of the losses. According to the model, two fire stations and one school would suffer moderate damage.

This model calculates loss, as opposed to the exposure calculations detailed in the Current Conditions Section derived by the TEIF analysis. The TEIF analysis includes all calculated losses in the floodplain, without consideration of the depth of the flood in different areas. Due to Carbon County's topography and geography, a building in the floodplain may not be at risk to high losses because of the level of inundation in that area. The HAZUS modeling process includes the development of a depth grid analysis that details the depth of the predicted flood based on the water area, the flood area, and the topography of the area; this detail is not included in the TEIF calculations, which results in higher calculated TEIF losses than HAZUS modeled estimated losses.

The HAZUS datasets only report losses in each Census Block that are over $1,000. Census Blocks that would experience less than $1,000 in building-related or business losses have a reported value of $0 in losses; however, these areas may experience minimal losses of less than $1,000. Using these datasets in HAZUS, total economic losses from a 1%-annual-chance flood in Carbon County are estimated at $1,000. There were no reported building losses for non-critical facilities. Figure 4.4-3 shows the areas that would experience economic loss due to a 1%-annual-chance flood in Carbon County.

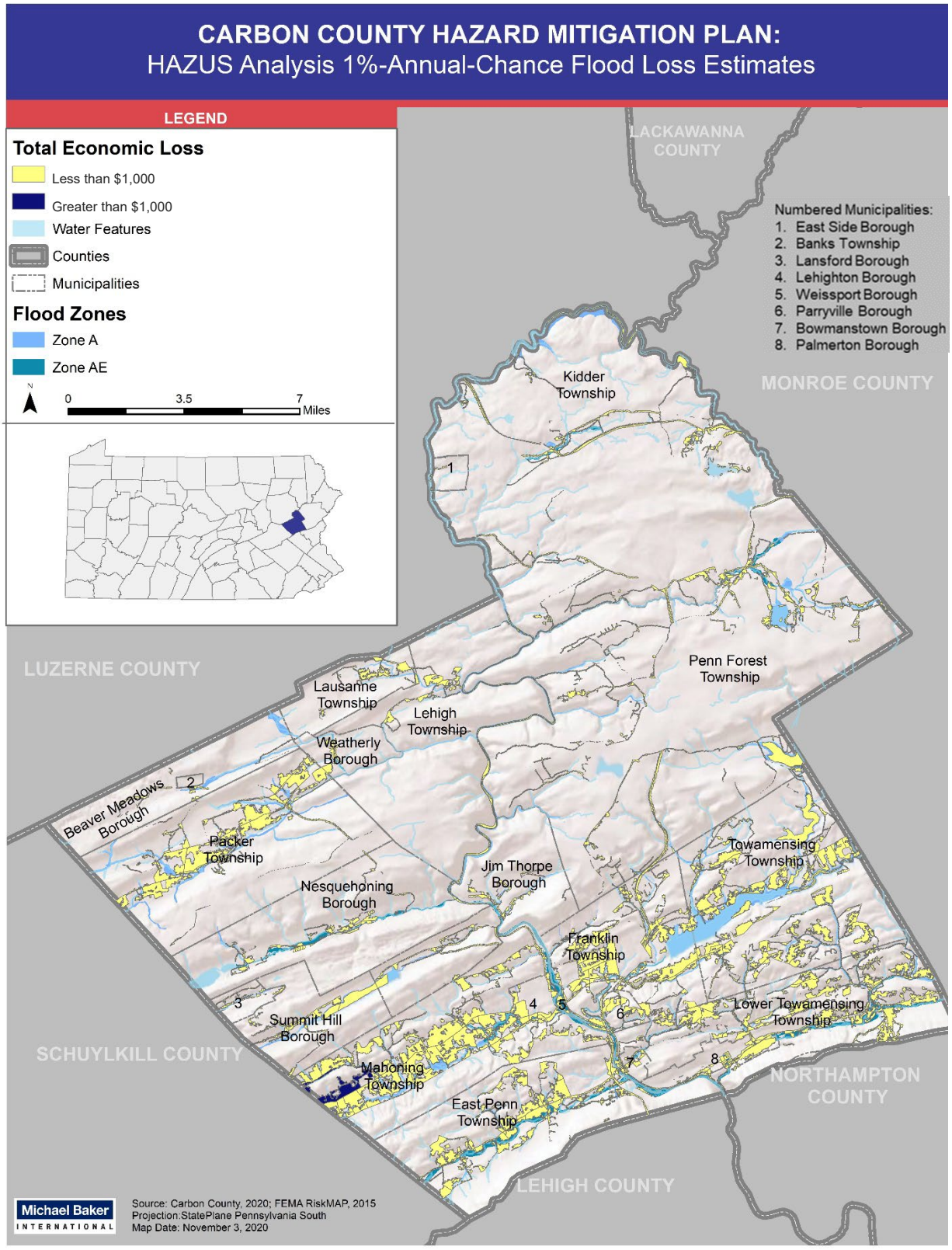
FIGURE 4.4-2: ECONOMIC LOSS ESTIMATES ($M) BY OCCUPANCY TYPE FOR CARBON COUNTY AS CALCULATED BY HAZUS



According to the model, there would be moderate damage to three police stations and three schools, and there would be loss of use for two police stations and two schools. Additionally, the HAZUS model estimates the number of households that are expected to be temporarily displaced from their homes due to the flood. These numbers show that while the total building damage to the residences may be less than $1,000, so not illustrated in the building losses, that the flood would impact households in the immediate aftermath of the incident. According to the model, an estimated 716 households will be displaced due to their proximity to inundated areas during the flood, which would result in an estimated number of 1,065 people seeking temporary shelter during the flood incident.

The full HAZUS results report can be found in Appendix F.

FIGURE 4.4-3 DISTRIBUTION BY CENSUS BLOCK OF THE POTENTIAL TOTAL ECONOMIC LOSS EXPECTED FROM A 1% ANNUAL-CHANCE FLOOD EVENT IN CARBON COUNTY.



4.4.4. Future Development and Vulnerability

Risk and vulnerability to natural and human-made hazard events are not static. Risk will increase or decrease as counties, and municipalities see changes in land use and development as well as changes in population. Carbon County is expected to experience a variety of factors that will, in some areas, increase vulnerability to hazards while in other areas, vulnerability may stay static or even be reduced.

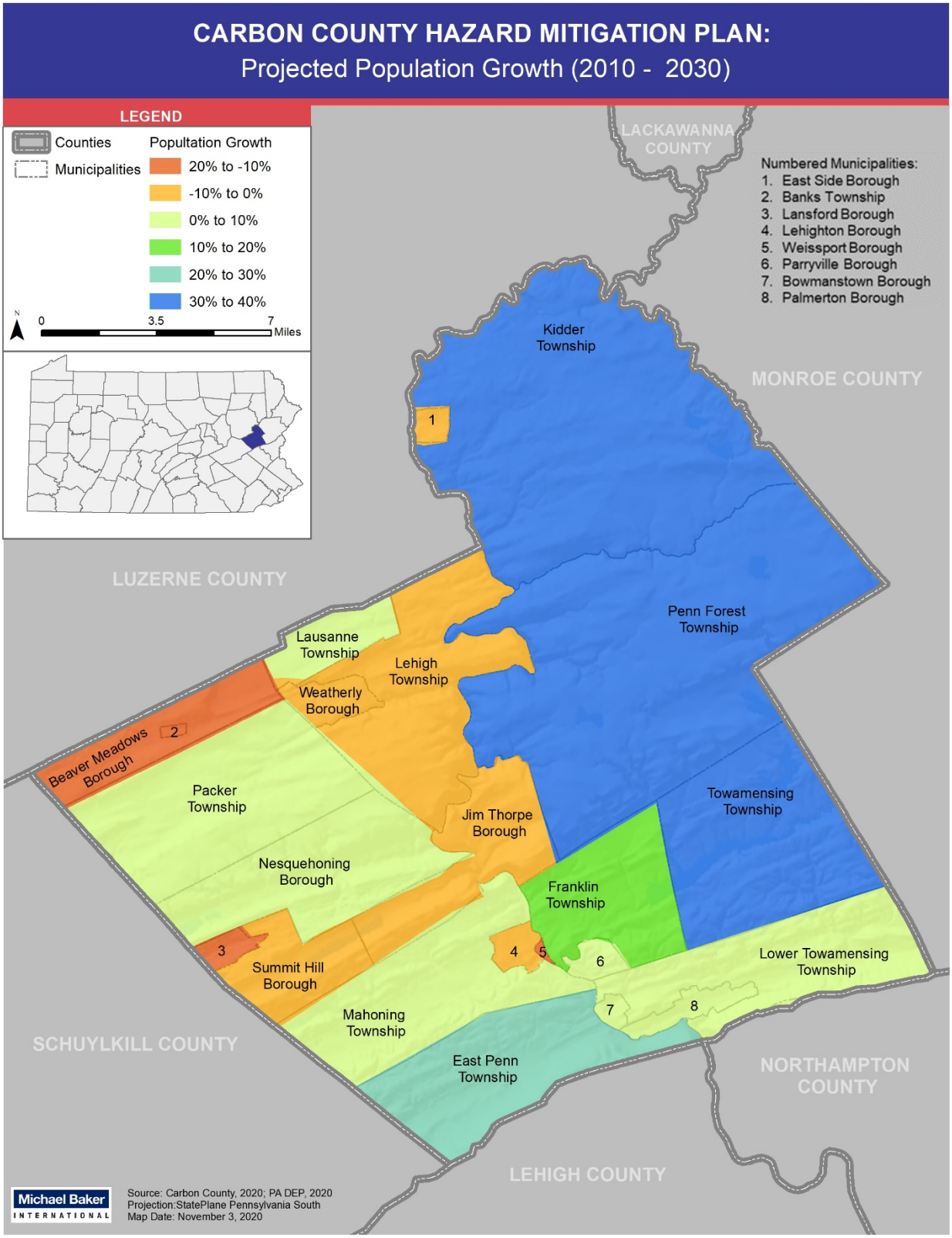
Population change is perhaps the most significant indicator of changes in vulnerability in the future. As discussed in Section 2.3., the total population of Carbon County decreased 2.1% from 2010-2019. Past growth was largely due to development pressure from New York and New Jersey to the west and increasing housing prices in the Lehigh Valley to the south. The relatively stable population in the last ten years shows that regional housing demands are being met outside of Carbon County. Population projections issued by the Pennsylvania Department of Environmental Protection (PADEP) estimate growth for the County from 2010 to 2040, with the County projected to increase in total population by over 25% during this timeframe (PA DEP, n.d.). It is important to note that these population figures are projections only and are derived from birth rates, death rates, and migration information and may not fully capture population dynamics.

However, as can be seen in Figure 4.4-4, future growth is not projected to be evenly distributed in the County. The municipalities that are expected to experience the most growth are Kidder, Penn Forest, and Towamensing Townships with growth rates ranging from 30-40%. In addition, Kidder and Penn Forest Townships have a large weekender population, meaning that the populations of these townships have the potential to increase significantly from Thursday-Sunday, year-round. This population growth and its associated development will likely create increases in loss estimates, as more people will be living in areas prone to hazards, especially flooding, winter storms, and wildfires.

The Carbon County Office of Planning and Development expects that the Pennsylvania Turnpike Commission's addition of a Pennsylvania Turnpike Interchange in Penn Forest Township has the potential to spur growth and increase development around the access point. According to the Pennsylvania Turnpike Commission, this EZ-Pass only exit is located at Route 903 between Mile Marker 74 and 95, and is designed to shorten travel time for commuters, ease traffic congestion at nearby interchanges, and provide additional access to the recreational opportunities in northeastern Carbon County. The interchange was opened in July 2015 (PA Turnpike, 2015).

The smaller boroughs, like Beaver Meadows; Lansford; and Lehighton; and Banks Township are projected to experience the greatest population losses in the County. These losses, coupled with physical development constraints in the western portion of the county like rugged terrain and steep slopes, cause risk to remain constant in these areas of the county. Additionally, the 20% of all County land held in state forests, state parks, and state gamelands will also stabilize some risks in the County.

FIGURE 4.4-4 PROJECTED POPULATION GROWTH (PADEP, 2012)



In addition to population growth, historical building permit activity provides insight into ongoing development in the County. The Department of Housing and Urban Development (HUD) maintains data on the number of building permits issued for residential construction by jurisdictions across the U.S., data which is culled from the U.S. Census Bureau's Building Permits Survey. The number of building permits by municipality for Carbon County was obtained from HUD's State of the Cities Data Systems (SOCDS) database for years 2015 through 2019.

Table 4.4-8 displays the number of residential building permits issued by municipality for Carbon County between 2015 and 2019. This is the most complete dataset for building permits available, as Carbon County is completely covered by permitting systems. Data for 2020 is not yet complete.

TABLE 4.4-8 BUILDING PERMITS ISSUED IN CARBON COUNTY BETWEEN 2015-2019 (HUD, 2021)

MUNICIPALITY	2015	2016	2017	2018	2019	TOTAL UNITS	PERCENT OF TOTAL UNITS IN COUNTY
BANKS TOWNSHIP	0	0	0	1	1	2	0.6%
BEAVER MEADOWS BOROUGH	0	0	0	0	0	0	0%
BOWMANSTOWN BOROUGH	0	0	0	1	0	1	0.3%
EAST PENN TOWNSHIP	1	5	2	2	2	12	3.8%
EAST SIDE BOROUGH	0	0	0	0	0	0	0%
FRANKLIN TOWNSHIP	1	1	0	8	8	18	5.7%
JIM THORPE BOROUGH	0	2	2	5	3	12	3.8%
KIDDER TOWNSHIP	8	6	7	16	6	43	13.6%
LANSFORD BOROUGH	0	0	0	0	1	1	0.3%
LAUSANNE TOWNSHIP	0	0	0	0	0	0	0%
LEHIGH TOWNSHIP	2	0	0	0	1	3	0.9%
LEHIGHTON BOROUGH	1	0	0	0	0	1	0.3%
LOWER TOWAMENSING TOWNSHIP	1	2	1	7	5	16	5.1%
MAHONING TOWNSHIP	4	1	2	7	1	15	4.7%
NESQUEHONING BOROUGH	0	0	0	0	0	0	0%
PACKER TOWNSHIP	1	2	2	0	0	5	1.6%
PALMERTON BOROUGH	6	3	6	4	2	21	6.6%
PARRYVILLE BOROUGH	0	0	0	0	0	0	0%
PENN FOREST TOWNSHIP	30	24	19	31	25	129	40.7%
SUMMIT HILL BOROUGH	0	0	0	0	0	0	0%
TOWAMENSING TOWNSHIP	4	8	6	5	13	36	11.4%

MUNICIPALITY	2015	2016	2017	2018	2019	TOTAL UNITS	PERCENT OF TOTAL UNITS IN COUNTY
WEATHERLY BOROUGH	0	0	1	0	1	2	0.6%
WEISSPORT BOROUGH	0	0	0	0	0	0	0%
GRAND TOTAL	59	54	48	87	69	317	100.00%

As seen from Table 4.4-8, the greatest share of growth in the County over the last five years has occurred in the Penn Forest Township, accounting for over 40% of all new residential construction. Growth in Penn Forest may be attributable to the interchange on Route 903 opened in 2015; additional analysis is needed to make this determination. The second to largest growth area in the County is Kidder Township with roughly 13% of growth. As mentioned previously, these municipalities are also projected to experience the greatest percentage of population growth in the County in the coming decades.

In November 2013, Carbon County adopted a Comprehensive Plan and Greenways Plan. The Comprehensive Plan helps to better define where growth will occur in the County. Although no key growth areas are designated in the 2013 plan, there is an expectation about what future growth will occur in the county as displayed in Figure 4.4-5. As seen in the map, Carbon County is expected to continue to be primarily rural with growth and development occurring in the townships where population growth has been the highest and where there are growing resort communities, particularly Kidder and Penn Forest Townships. Additional growth is expected to occur around major transportation corridors in the County, specifically between Interstate 80 and Route 940; Route 903; and Route 534. Other areas designated for redevelopment include a 59-acre brownfield site in Lehighton Borough and Manhoning Townships east of Route 248 and the former Palmerton Zinc Company site in Palmerton Borough. The former Palmerton Zinc Company is a brownfield site with ongoing remediation. A portion of the site, the east site, has successfully been remediated and has active businesses onsite.

The 2013 Comprehensive Plan and Greenways Plan is the first countywide comprehensive plan to incorporate a greenways plan, thus solidifying the value and location of natural areas and green infrastructure that may serve to maintain or reduce the risk and vulnerability in the county. The greenways portion of the Comprehensive Plan places an emphasis on the maintenance of a variety of protected and recreational space. These areas can be seen in Figure 4.4-6.

Key greenways and green infrastructure identified by the County include:

- The main trails in the County, including the Appalachian Trail, Delaware and Lehigh Trail, The Lehigh River Water Trail, and Buckwha Rails to Trails; Delaware River Water Trail, Switchback Trail, and Glen Onoko Falls;
- Environmentally sensitive areas like the 1 percent annual chance floodplain, wetlands, surface water, and existing natural and conservation areas;
- Protected open space like State Forests, State Gamelands, State, County, and Municipal Parks;

- Federal recreation areas, including the Francis E. Walter Dam;
- Farmland, including protected easements, Agricultural Security Areas, and primary agricultural land;
- Steep slopes 15% or greater;
- Ridge tops and scenic viewsheds; and
- Important Natural Areas like Important Bird Areas, Important Mammal areas, and Wildlife habitat and migration patterns.

In the Greenways Plan, the County recommends that specific areas in the County be designated as recreational or conservation greenways. Recreational greenways identified by the County include the Appalachian Trail and the Blue Mountain/Kittatiny Ridge, Lehigh Gap Nature Center, Chestnut Ridge Greenway, Delaware & Lehigh Trail and Lehigh River Greenway, Switchback Railroad Trail, and Panther Valley Heritage Trail. Conservation greenways are focused on the of waterways and ridgelines to improve the quality and quantity of water in the County and include Mauch Chunk Ride; Nesquehoning Mountain; areas between State Game Lands 40 and the Lehigh River in Kidder Township; and Black Creek, Buck Mountain Creek, Lizard Creek, Mud Run, Nesquehoning Creek and Quakake Creek Greenways (Carbon County, 2013).

In addition, Carbon County recognizes the development pressure it is experiencing and has worked to preserve land through the PA Act 319, otherwise known as the Clean and Green Act (1074). This voluntary program allows owners of agricultural, agricultural reserve, or forest reserve land to apply for preferential assessment of their land. The landowners must preserve a minimum of ten acres of land and must maintain the original use of the land indefinitely or face a penalty of roll-back taxes. According to the Pennsylvania Department of Agriculture's Annual Farmland Preservation Report, 19,440 acres of land (305 parcels) representing 7.9% of all land area in Carbon County have been preserved using this legislation (PDA, 2019). This is an increase from 2.2% of land in 2015. The preserved land is geographically concentrated in the southern section of the County, especially in East Penn Township, Mahoning Township, Packer, Penn Forest, and Towamensing Township. This preservation will likely decrease or stabilize these communities' hazard vulnerability.

Making use of the analysis of Carbon County's current and future population and development trends, it is important to explore how these projected changes may influence the County's future vulnerability to the profiled hazards. Hazard vulnerability and loss potential will be higher in the places of higher density throughout the County. For example, population growth and its associated development is likely to create increases in loss potential, as more people may be living in areas prone to hazards. For example, while development occurs most often along transportation networks, because of their access and the increased demand for travel and access to services, this additional development increases the vulnerability to transportation incidents. Key hazards that are specific to Carbon County's growth and development trends include flooding, wildfire, and transportation accidents.

As discussed previously, Carbon County's comprehensive plan incorporates growth management strategies and appropriate recommendations to protect environmentally sensitive areas and preserve open space, which may help to funnel growth away from hazard-prone areas. In addition, while there may be growth areas that include SFHA or other hazard areas, to comply with state requirements, municipalities have floodplain regulations that limit construction within flood-prone areas and other hazard or environmentally sensitive areas.

These provisions are included within each municipality's and the county's subdivision and land development ordinance.

This updated hazard mitigation plan can be used in tandem with the County's Comprehensive Plan and Greenway Plan to guide future development because it identifies areas that may be more prone to hazards. Utilizing both the maps associated with the hazard mitigation plan and the County's future land use plan can assist Carbon County in accomplishing their goals of development and make them less prone to the negative impacts of hazards.

FIGURE 4.4-5 CARBON COUNTY FUTURE LAND USE PLAN (CARBON COUNTY, 2013)

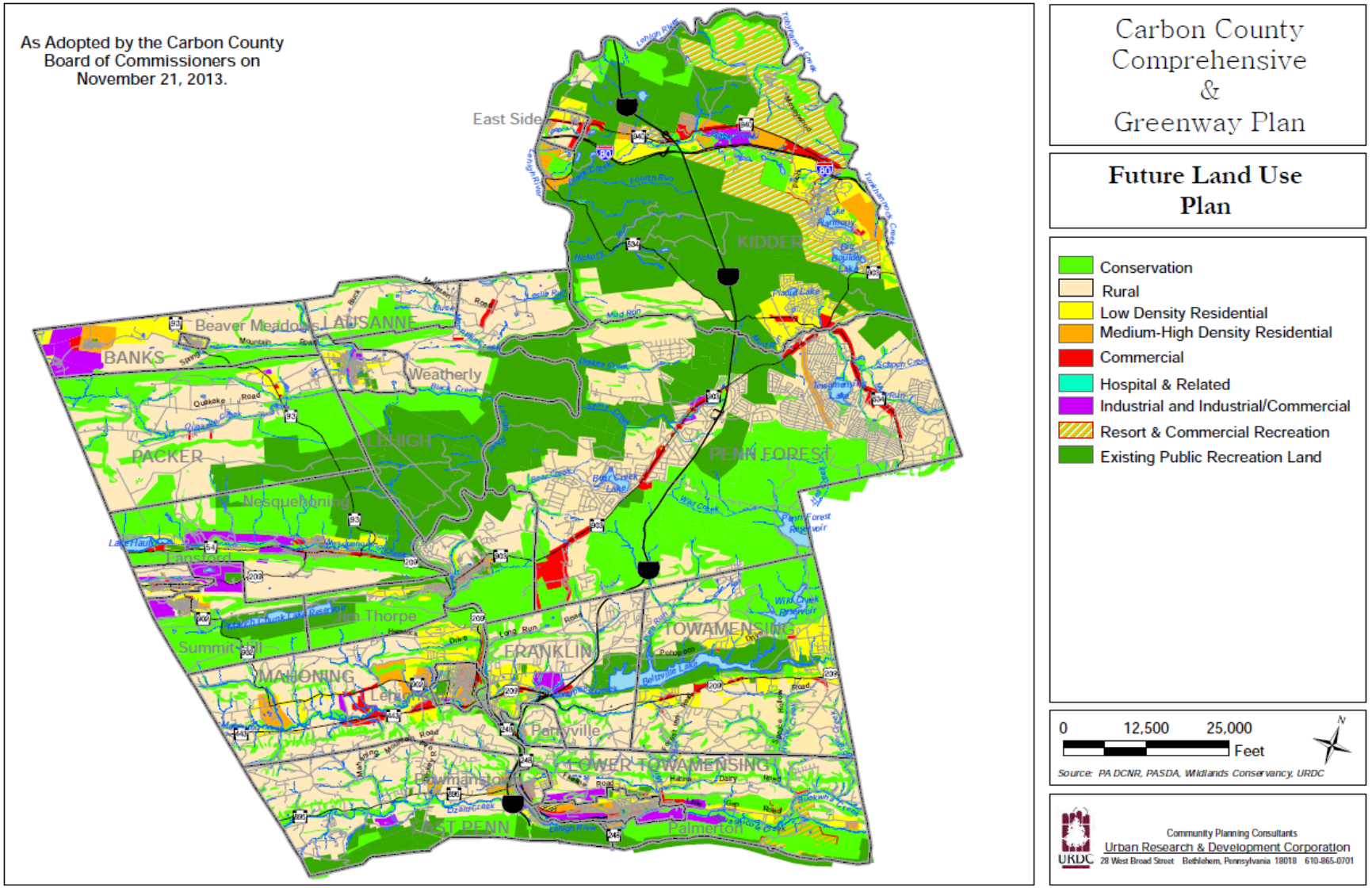
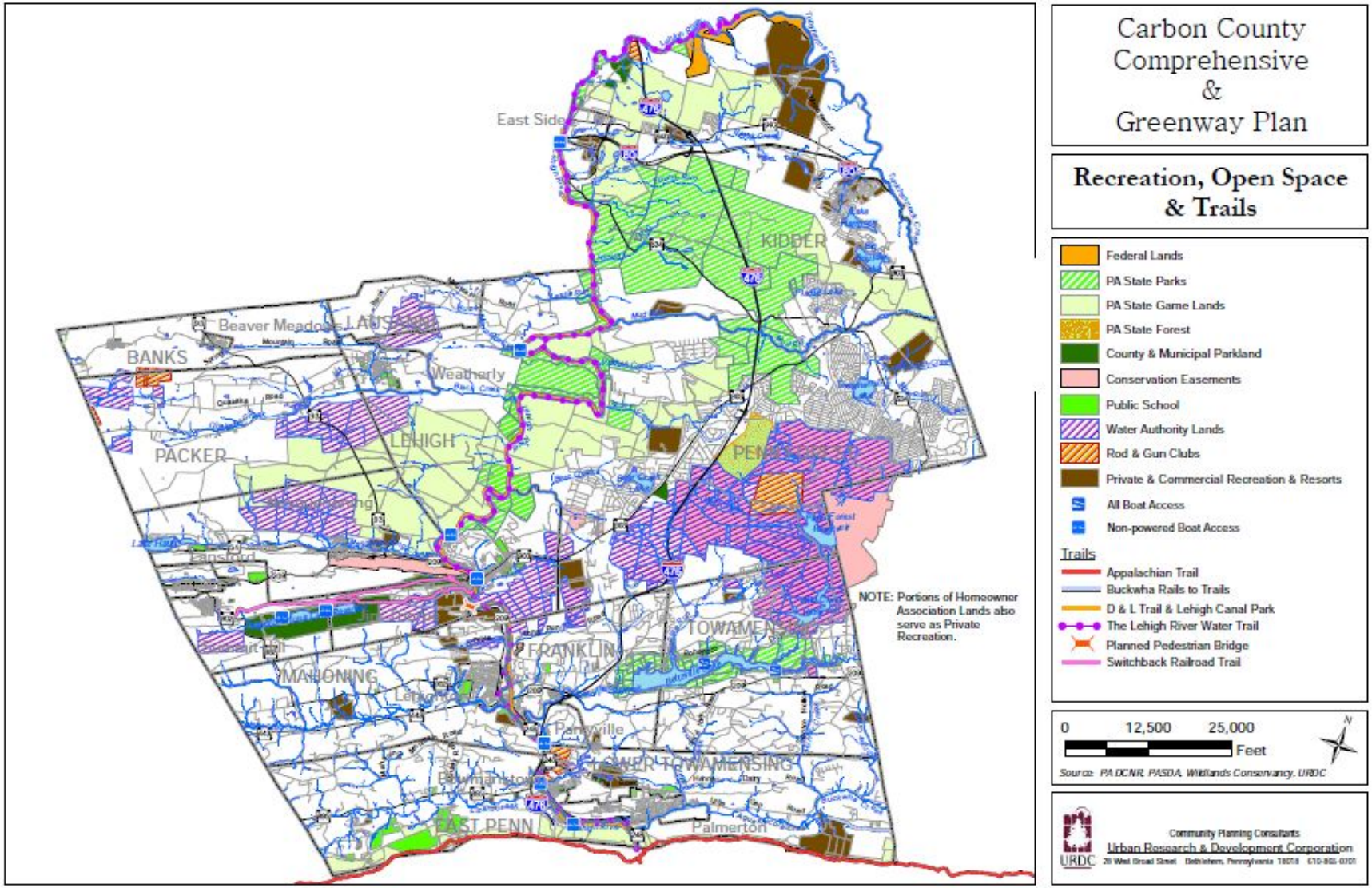


FIGURE 4.4-6 CARBON COUNTY RECREATION, OPEN SPACE & TRAILS (CARBON COUNTY, 2013)



5. Capability Assessment

5.1. *Update Process Summary*

The purpose of the Capability Assessment is to identify strengths and weaknesses that will affect the ability of the County and participating jurisdictions to implement mitigation actions. It is important to perform a mitigation capability assessment in order to develop a comprehensive and implementable mitigation strategy. Capabilities include a variety of regulations, existing planning mechanisms, and administrative capabilities provided through established agencies or authorities. This assessment will allow Carbon County to better evaluate its current resources to implement its mitigation strategy to address the potential hazards which make the County and its local municipalities vulnerable. While the capability assessment serves as a good instrument for identifying local capabilities, it also provides a means for recognizing gaps and weaknesses that can be resolved through future mitigation actions. The results of this assessment lend critical information for developing an effective mitigation strategy.

Carbon County has a number of resources it can access to implement hazard mitigation initiatives including local planning and regulatory tools, administrative assistance and technical expertise, fiscal resources; use of local, regional, state, and federal funding sources; and educational outreach methods. The presence of these resources enables community resiliency through actions taken before, during, and after a hazard event.

During the 2010 HMP process, local plans, ordinances, and codes were identified for each municipality. Through responses to the *Capability Assessment Survey* distributed to all of the County's municipalities and input from the HMSC and the HMPT, the 2010 HMP provided an inventory of the most critical local planning tools available within each municipality and a summary of the fiscal and technical capabilities available through programs and organizations outside of the County. It also identified emergency management capabilities and the processes used for implementation of the NFIP.

For the 2015 HMP update, a revised Capability Assessment Survey was developed based on the most recent FEMA and PEMA guidance. The survey contained three main sections including: planning and regulatory capability, administrative and technical capability, and self-assessment of capability. To assist municipalities in reducing the amount of time needed to complete the survey, survey responses received from each municipality as part of the 2010 HMP Update were pre-populated in a survey for each municipality. If a municipality did not complete a survey from the 2010 HMP Update, they were provided with a survey including the municipal name but no pre-populated information. Communities were then invited to update and/or confirm the information for 2015. The Capability Assessment survey was provided in both hard copy (meeting handout) and electronic format (via e-mail and/or via the project website) to each municipality. In addition, Carbon County Office of Planning and Development (CCOPD) completed a Capability Assessment Survey to identify county-level capabilities.

The 2021 Capability Assessment provides an updated inventory of local planning and regulatory tools available, a summary of fiscal and technical capabilities, and discusses opportunities to integrate the HMP into other plans and programs to promote implementation. A new Capability Assessment Survey was disseminated to all municipalities to

collect information on their planning and regulatory capabilities including plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards.

While the capability assessment serves as a good instrument for identifying local capabilities, it also provides a means for recognizing gaps and weaknesses that can be resolved through future mitigation actions. The results of this assessment lend critical information for developing an effective mitigation strategy.

5.2. *Capability Assessment Findings*

Carbon County and participating jurisdictions have a variety of plans, tools, and resources in place to support the goals of hazard mitigation planning, and the specific mitigation strategy presented in this HMP Update.

5.2.1. Planning and Regulatory Capability

The purpose of a plan/ordinance review as part of this planning process is trifold:

- To identify existing Commonwealth, Regional/County, and Municipal initiatives;
- To provide an inventory and review of sample plans and ordinances and identify sections in these documents that address hazard mitigation-related issues; and
- To provide a platform to integrate plans and other documents so recommendations and strategies are not in contradiction with one another (e.g., between the hazard mitigation plan and the comprehensive plan).

A review of current zoning and subdivision ordinances, comprehensive plans, open space and recreation plans, stormwater management plans, sediment and erosion control plans, and emergency operations plans, among others, are summarized below by level of administration (Commonwealth, Regional, County, and Municipal).

COMMONWEALTH OF PENNSYLVANIA DOCUMENT REVIEW

- The 2018 Pennsylvania State Hazard Mitigation Plan Update goals and objectives that are applicable to this Carbon County Plan Update including (PEMA, 2018b):
    - Protect lives, property, environmental quality, and resources of the Commonwealth;
    - Enhance consistent coordination, collaboration, and communications among stakeholders;
    - Provide a framework for active hazard mitigation planning and implementation; and
    - Increase awareness, understanding, and preparedness across all sectors.

  Hazard identification and risk assessment data from the 2018 Pennsylvania State Hazard Mitigation Plan Update has been incorporated into the appropriate sections of this Plan Update.

- The Uniform Construction Code (UCC) is the statewide building code (Act 45 of 1999) that took effect in Pennsylvania in April of 2004 and was amended most recently in 2020. The UCC is mandated by the State for all municipalities in Pennsylvania and establishes minimum regulations for most new construction, including additions and renovations to existing structures. All new construction is required to meet the UCC requirements statewide.

- The Commonwealth of Pennsylvania Governor's Executive Order 1999-1 (Land Use Planning) provides the basis for the requirement to integrate hazard mitigation into comprehensive land use planning. As part of this executive order, the Interagency Land Use Team was established, comprising the following state agencies: Department of Agriculture; Department of Community and Economic Development; Department of Conservation and Natural Resources; Department of Environmental Protection; Governor's Green Government Council; Fish and Boat Commission; Game Commission; Department of Transportation; and PEMA. One of the most significant outcomes of PEMA's participation on the team is the integration of hazard mitigation goals and objectives into comprehensive land use planning processes.
- The Pennsylvania Erosion and Sediment Control Code requires all earthmoving projects in the Commonwealth to develop an erosion and sediment pollution control plan to ensure that proper site development practices are employed for land development and implement best management practices for the control of sediment pollution during construction. Pennsylvania DEP requires a National Pollution Discharge Elimination System (NPDES) permit for earthmoving activities exceeding one acre. As well as erosion and sediment pollution control during construction, the permit also addresses post-construction stormwater management.
- Act 165: Hazardous Materials Emergency Planning and Response Act, amended in 2001, established a Statewide hazardous materials safety program. This created the Hazardous Materials Response Fund, county Hazardous Material Emergency Response Accounts, and further provided duties to PEMA and the Pennsylvania Emergency Management Council. This Act requires facilities with extremely hazardous chemicals on site to create Off-site Emergency Response Plans, which are then presented to Local Emergency Planning Committees.

REGIONAL/COUNTY DOCUMENT REVIEW

- Hazard mitigation plans (HMPs) such as this 2021 Carbon County HMP Update, describe in detail the hazards that may affect the community, the community's vulnerability to those hazards, and an action plan for how the community plans to minimize or eliminate that vulnerability. HMPs are governed by the Disaster Mitigation Act of 2000 (DMA 2000). Having a FEMA-approved HMP makes the jurisdiction eligible for federal mitigation funding.
- Carbon County's current Comprehensive Plan & Greenway Plan was adopted on November 21, 2013 by the Carbon County Board of Commissioners. The Plan provides a general direction and blueprint for the future of Carbon County and constituent communities, particularly as it pertains to resource preservation and land conservation. Comprehensive Plans promote sound land use and regional cooperation among local governments to address planning issues. These plans serve as the official policy guide for influencing the location, type and extent of future development by establishing the basis for decision-making and review processes on zoning matters, subdivision and land development, land uses, public facilities and housing needs over time. Pennsylvania's MPC (Act 247 of 1968), as reauthorized and amended, requires counties to prepare and maintain a county comprehensive plan and to update it every 10 years.
- Two multi-municipal regional plans were developed to address specific issues and characteristics of the Central Region (Franklin, East Penn and Mahoning Townships,

and Weissport and Lehighton Boroughs) and the Middle Region (Penn Forest Township, and Jim Thorpe, Summit Hill and Lansford Boroughs). Also, several jurisdictions in the County have local municipal comprehensive plans and include: Beaver Meadows, East Side, Nesquehoning, and Weatherly Boroughs and Kidder, Lausanne, and Lehigh Townships. County governments are required by law to adopt a comprehensive plan, while local municipalities may do so at their option. All municipalities in Carbon County are covered, in some capacity, under the county or a regional or local comprehensive plan.

- With regard to hazard mitigation planning, Section 301(a)2 of the MPC requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the Plan give consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services, and recommends giving consideration to storm drainage and floodplain management. The 2013 Comprehensive Plan and Greenway Plan considers findings from the 2010 HMP and future updates and improvements will continue to incorporate HMP findings.
- The Commonwealth has adopted the 2020 UCC, which is the most recent update. All municipalities in Carbon County are required to adhere to the UCC building codes. Twenty out of the twenty-three municipalities in the County "opt-in" to the UCC (PA L&I, 2015). The HMSC indicated that some municipalities that "opt-out" in Carbon County might do so because of the ICC Wildland-Urban Interface Code, as many municipalities rely on well water and implementation of the code could halt development in these municipalities. Building codes relate to hazard mitigation through requirements about building materials and methods that have been professionally evaluated for quality and safety, as well as inspection requirements. Municipalities have the option to adopt more stringent requirements that enhance resistant or resilience building design practices.
- Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures located in the floodplain are flood-proofed, dry-proofed, or built above anticipated flood elevations. Floodplain ordinances may also prohibit development in certain areas altogether. The NFIP establishes minimum ordinance requirements which must be met in order for that community to participate in the program. However, a community is permitted, and in fact, encouraged to adopt standards which exceed NFIP requirements. Through participation in the NFIP, all municipalities within the County have floodplain regulations in place including Beaver Meadows Borough which has no identified SFHAs.
- Subdivision and land development ordinances (SALDO) are intended to regulate the development of housing, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Within these ordinances, guidelines on how land will be divided, the placement and size of roads and the location of infrastructure can reduce exposure of development to hazard events. Zoning ordinances allow for local communities to regulate the use of land in order to protect the interested and safety of the general public. Zoning ordinances can be designed to address unique conditions or concerns within a given community. They may be used to create buffers between structures and high-risk areas, limit the type or density of development and/or require land

development to consider specific hazard vulnerabilities. All jurisdictions within Carbon County have adopted and enforce either a SALDO or zoning ordinances.

- Firewise is a national program that brings together the response community, community planners, and homeowners to minimize the risk of wildfires. The program focuses on development that is compatible with the natural environment. Participation in the program is begun and maintained by groups of homeowners. As of 2021, one jurisdiction in Carbon County participates in the Firewise program. Carbon County assists communities in the establishment of a Firewise community rating for the local municipality and provides trainings and exercises in cooperation with the Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry.
- Farmland preservation measures are important to hazard mitigation. Preserved farms protect soil from erosion and prevent the contamination of local surface water. In addition, farms and forest land are important for recharging the community's aquifer and providing habitat for local wildlife. Carbon County has a very active agricultural land preservation program overseen by the Carbon County Agricultural Land Preservation Board, which works closely with the Conservation District. As discussed in Section 4.4.4, Carbon County has taken steps to preserve land through the PA Act 319, otherwise known as the Clean and Green Act (1074). Additional planning mechanisms employed by the County include the use of agricultural conservation easements and Agricultural Security Areas (ASAs). Agricultural conservation easements restrict the conversion of agricultural land for development by placing a permanent conservation easement on the land. Landowners voluntarily sell the easement to government agencies or a private conservation organization, who compensates the landowner and strictly prohibits the use of the land for nonagricultural purposes (Carbon County, 2013; APA, 2012). Unlike easements, ASAs are not legally binding, but are a means to express the intent of the landowner to use the land for agriculture.
- The Carbon County Emergency Management Agency (CCEMA) coordinates countywide emergency management efforts. The HMSC indicated that the CCEMA also participates in regional planning efforts through a Regional Long-Term Recovery Committee (LTRC). The LTRC consists of private sector representatives, local volunteers and government representatives from Carbon, Lehigh, Monroe, and Northampton Counties and works to coordinate community recovery and reconstruction. Each municipality in Carbon County has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazard events have on their community. A significant amount of information used to develop this plan was obtained from the emergency management coordinators.
- All 23 municipalities in Carbon County have a local Emergency Operations Plan (EOP) and a countywide EOP also exists. Municipalities are not required to sign on to the County EOP, because County staff prefers to keep municipal emergency management coordinators actively engaged at a more local level. Carbon County also has community-led resources dedicated to emergency response, such as a Community Emergency Response Team (CERT) with over 600 active members in 2010, Carbon County Citizen Corps volunteer response, education, and training team, and a County Animal Response Team (CART) to assist in animal related emergencies in the County (Carbon County, 2013). In addition, the County has a community alert system that emergency management personnel can use to notify residents of important information during a major crisis or emergency impacting the County. Carbon County

residents can register for the text notifications via the Code Red website at https://public.coderedweb.com/CNE/en-US/BF83454BD00C.

- The Carbon County Natural Areas Inventory is a list that contains information on rare, threatened, and endangered plant and animal species and the highest quality natural areas in the county; it is not a complete inventory of open space. It is intended as a conservation tool, and there is an opportunity to align these activities with hazard mitigation priorities and goals.
- A Profile of Wildfire Risk for the Towamensing Trails area in Carbon County was completed by Headwaters Economics and identifies data about wildfire risk, socioeconomic vulnerability, and land use to help communities understand their relative wildfire risk profile. There is an opportunity to use this data to inform wildfire and other hazard mitigation activities.
- The Carbon County Return on Environment Report details the careful protection, management, and use of its natural resources that are essential to the long-term sustainability of nature and the local and regional economies. The goals of this plan to conserve and protect the County's environmental and natural resources align with the current and future hazard mitigation planning efforts.

5.2.1.1. Participation in the NFIP

All 23 municipalities in Carbon County are participants in the NFIP (see Table 5.2-1). The program is managed by local municipalities participating in the program through ordinance adoption and floodplain regulation while the Carbon County Office of Planning and Development provides an oversight and coordination role. Similarly, permitting processes needed for building construction and development in the floodplain are implemented at the municipal level through various ordinances (e.g. zoning, subdivision/land development and floodplain ordinances).

FEMA Region 3 makes available to communities, an ordinance review checklist which lists required provisions for floodplain management ordinances. This checklist helps communities develop an effective floodplain management ordinance that meets federal requirements for participation in the NFIP.

The Pennsylvania Department of Community and Economic Development (DCED) provides communities, based on their 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.

Act 166 mandates municipal participation in and compliance with the NFIP. It also establishes higher regulatory standards for hazardous materials and high-risk land uses. As new FIRMs are published, the Pennsylvania State NFIP Coordinator housed at PEMA, 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. In addition, PEMA provides guidance and technical support through Community Assistance Contacts (CAC) and Community Assistance Visits (CAV).

Carbon County municipalities are currently utilizing 2002 FIRMs. The maps greatly enhanced mitigation capabilities as they relate to identifying flood hazards and is a significant improvement to the previously effective paper Flood Insurance Rate Maps. Residents and

municipal officials are provided with mapping assistance from the Carbon County GIS Department and the Carbon County Office of Planning and Development upon request.

For a community to participate in the NFIP, it must adopt and enforce floodplain management regulations that meet or exceed the minimum NFIP standards and requirements. These standards are intended to prevent loss of life and property, as well as economic and social hardships that result from flooding. Once FEMA provides communities with flood hazard information upon which floodplain management regulations are based, the community is required to adopt a floodplain ordinance that meets or exceed the minimum NFIP requirements. All NFIP participating communities in Carbon County have either adopted a stand-alone ordinance or have arranged for County administration of floodplain regulations.

The overriding purpose of the minimum floodplain management regulations as outlined by the Code of Federal Regulations (44 CFR) is to ensure that participating communities consider flood hazards, to the extent that they are known, in all official actions relating to land management and use. Municipalities range from "A" to "E" levels of regulation based on their identified flood zones. In Centre County, 3 municipalities are Level "A" indicating they have no FEMA identified flood hazard areas, 6 are Level "B", 18 are Level "C", and 8 are Level "D" indicating that a floodway has been designated for certain flooding sources. Regulations become more comprehensive as you move from A to E and are dependent on whether a municipality has identified flood hazard areas, flood elevations, floodways, or coastal high-hazard areas.

Nine communities submitted the 2021 NFIP Survey. Based on these forms, historical knowledge, and input from Carbon County it is determined that all NFIP participating communities in Carbon County have either adopted a stand-alone ordinance or have arranged for County administration of floodplain regulations. Some communities make paper maps available to the public in their Municipal Building while others utilize eMapPA at https://www.depgis.state.pa.us/emappa/. Additionally, Subdivision Regulations or Zoning Ordinances are in place locally. Many communities have included Floodplain Ordinance into their Zoning Ordinance rather than a standalone ordinance. As such, these localities are enforcing floodplain ordinances and taking remedial action to correct any violations through their Zoning Ordinances by either the Zoning Officer or their Township Engineer.

TABLE 5.2-1 CARBON COUNTY NFIP INFORMATION BY MUNICIPALITY (CIS, 2021).

MUNICIPALITY	PARTICIPATION STATUS	COMMUNITY IN GOOD STANDING	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE
Banks Township	P	Yes	0	$0
Beaver Meadows Borough	P	Yes	0	$0
Bowmanstown Borough	P	Yes	7	$709,961
East Penn Township	P	Yes	5	$524,989
East Side Borough	P	Yes	0	$0
Franklin Township	P	Yes	12	$1,884,769
Jim Thorpe Borough	P	Yes	7	$869,282
Kidder Township	P	Yes	7	$1,598,453

Lansford Borough	P	Yes	1	$52,000
Lausanne Township	P	Yes	0	$0
*Lehigh Township	P	Yes	1	$333,159
Lehighton Borough	P	Yes	2	$378,645
Lower Towamensing Township	P	Yes	19	$4,116,657
Mahoning Township	P	Yes	12	$3,522,441
Nesquehoning Borough	P	Yes	15	$4,254,162
Packer Township	P	Yes	2	$133,718
Palmerton Borough	P	Yes	40	$6,676,942
Parryville Borough	P	Yes	2	$158,721
Penn Forest Township	P	Yes	17	$4,829,721
Summit Hill Borough	P	Yes	0	$0
Towamensing Township	P	Yes	3	$298,772
Weatherly Borough	P	Yes	2	$843,973
Weissport Borough	P	Yes	33	$3,673,688

There are no communities in Carbon County currently participating in the NFIP Community Rating System (CRS) (FEMA CIS, 2021). However, there are mitigation actions to increase awareness of CRS participation and benefits.

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program (NFIP). Over 1,500 communities participate nationwide.

In CRS communities, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community's efforts that address the three goals of the program:

- Reduce and avoid flood damage to insurable property
- Strengthen and support the insurance aspects of the National Flood Insurance Program
- Foster comprehensive floodplain management

5.2.1.2. Carbon County Capabilities

Major planning tools were identified by the municipalities during the planning process, as well as through Carbon County records. This information was gathered from Capability Assessment Forms filled out by local officials. In some cases, more current data was provided by the County and form responses were updated to reflect that information.

All municipalities in Carbon County have an Emergency Manager who maintains the Emergency Operations Plan. All municipalities in the County also have Floodplain Management Ordinances. Eight of eleven municipal respondents noted they have adopted comprehensive land use plans. Nine of eleven respondents noted they have adopted building codes. These planning tools are the lowest thresholds for participation in hazard mitigation planning and implementation.

Some municipalities have been able to employ additional planning tools or enroll in preparedness programs. Kidder Township, Lehighton Borough, and Weatherly Borough indicated having Streambank Buffer Protection Programs. Natural system protection programs such as these can help mitigate flooding and reduce hazard impacts. Additionally, Lehighton Borough adopted a Climate Change Adaptation Plan, a planning mechanism with the goal to reduce greenhouse gas emissions and slow impacts of climate change.

Kidder Township has certification in the National Weather Service's StormReady program, StormReady prepares municipalities for disaster mitigation and response by establishing a local emergency operations center and emergency warning systems, educating the community, and developing a formal hazardous weather plan. East Side Borough and Lehigh Township report conducting seasonal outreach for management and mitigation of various hazards.

Administrative and technical capabilities can be evaluated through a survey of municipal staff positions. The assessment for this plan determines whether communities have engineering departments, code enforcement departments, chief building officers, construction project managers, and grant writers and administrators. Most communities report having a code enforcement department and a chief building officer. However, communities are less likely to have an engineering department or construction project managers. Only three communities reported having grant writers and administrators on staff, reducing overall capability to garner grant funding throughout the County.

Communities in Carbon County report varying degrees of financial capability. Of eleven respondents, only Lehighton Borough reports having a Capital Improvement Program. These are essential for maintaining critical infrastructure at the local and county level. Four municipalities report having access to federal funding aside from FEMA grant programs; East Side Borough, Kidder Township, Lansford Borough, and Palmerton Borough. Communities that can garner federal funds have administrative capabilities to seek and manage grant funds, in addition to compelling projects that need immediate funding. East Side Borough, Lansford Borough, and Weatherly Borough report enacting utility fees for stormwater, water, sewer, gas, and/or electric. Additional funds through fee schedules can allow communities to finance mitigation projects over the long term.

5.2.2. Administrative and Technical Capability

Administrative capability is described by an adequacy of departmental and personnel resources for the implementation of mitigation-related activities. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract outside resources for this expertise in order to effectively execute mitigation activities. Common examples of skill sets and technical personnel needed for hazard mitigation include: planners with knowledge of land development/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 the education or 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.

Based on assessment results, many municipalities in Carbon County are equipped with Code Enforcement Officers, however very few have their own Engineer or Chief Building Officer. This result is not necessarily surprising since these tasks are typically contracted to outside providers. Many communities do not have their own personnel skilled in geographic information systems but have identified that the County GIS Department is able to provide these services. The County let us know that all municipalities in the County have an emergency management coordinator. Additionally, few communities have a grant administrator or grant writer, which might lend a hand in many communities not having knowledge of various funding sources. There is opportunity within Carbon County to integrate capabilities to potentially increase effectiveness and efficiency while mitigating hazards.

Other local organizations that could act as partners include the Carbon County Conservation District, the Penn State Cooperative Extension, the Carbon County Fire Chiefs, the Carbon County Groundwater Guardians, the Carbon County Citizen Corps Council, business development organizations such as the Carbon County Chamber of Commerce, and historical or cultural agencies such as the Mauch Chunk Historical Society of Carbon County. In addition, The Carbon County Agricultural Land Preservation Board is appointed to oversee the selection and purchase of agricultural conservation easements in the County. The board, which works closely with the Conservation District, can help farmers apply for an easement and see how individual farms will rate against other applicants. As the facilitator of farmland preservation, the board has an important role in preserving contiguous belts of farmland throughout the County.

Regional or statewide organizations that could act as partners or provide technical assistance include but are not limited to:

- The Pennsylvania Land Trust Association: The Pennsylvania Land Trust Association (PALTA), which consists of nonprofit and land conservation groups. PALTA has developed model easements that are available on the association website (http://www.conserveland.org). The model easements include:
    - Pennsylvania Conservation Easement
    - Riparian Forest Buffer Protection Agreement
    - Water Quality Improvement Easement
- Natural Lands Trust

- Wildlands Conservancy
- Chesapeake Conservancy
- Appalachian Mountain Club – Delaware Valley Chapter
- SEDA-Council of Governments (SEDA-COG)

State agencies which can provide technical assistance for mitigation activities include, but are not limited to:

- Pennsylvania Department of Community and Economic Development (DCED);
- Pennsylvania Department of Conservation and Natural Resources (DCNR);
- Pennsylvania Department of Environmental Protection (PA DEP);
- Pennsylvania Department of Health; and
- Pennsylvania Department of Transportation (PennDOT).

Federal agencies which can provide technical assistance for mitigation activities include, but are not limited to:

- United States Army Corp of Engineers;
- Department of Housing and Urban Development;
- Department of Health and Human Services;
- Department of Agriculture;
- Economic Development Administration;
- Emergency Management Institute;
- Environmental Protection Agency;
- FEMA; and
- US Small Business Administration.

5.2.3. Financial Capability

A critical part to the implementation of any plan is the financial resources to accomplish the priority projects identified. The implementation of mitigation actions requires time and fiscal 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 utilize state or federal mitigation grant funding opportunities that require local-match contributions. Based on the *Capability Assessment Survey* results received, most municipalities within the County perceive fiscal capability to be limited; however, several communities listed this capability to be moderate to high.

The key factor in determining fiscal capability is to analyze how tight these constraints are. This could involve a detailed auditing process to tally all revenues and expenditures or could involve an assessment of existing financial ratings as identified and reported by the DCED. These ratings can be used as a base indicator of fiscal capability at the municipal level. The Pennsylvania Municipalities Financial Recovery Act (Act 47 of 1987) identified fiscally distressed municipalities based on established criteria and authorized the DCED to assist in developing financial recovery plans in these areas. Analysis of the Act 47 fiscally distressed municipality list indicated that none of Carbon County's municipalities were identified as being fiscally distressed according to the established rating criteria.

Though the smaller, less populous municipalities do not have sufficient budgets to do costly mitigation projects without financial assistance, this does not preclude these municipalities from participating in hazard mitigation activities. Cooperative arrangements, coordinated efforts, and resource efficiency may serve as effective avenues for overcoming fiscal constraints and accomplishing hazard mitigation objectives at the local level.

Support for mitigation planning actions is most often provided by the Commonwealth of Pennsylvania and the Federal Government. Programs that complement Carbon County mitigation planning initiatives include the following state and federal programs.

- Pennsylvania administered programs including:
    - Shared Municipal Services, which provides grant funds to promote cooperation among municipalities.
    - Land Use Planning and Technical Assistance Program, which provides grant funds for the preparation of community comprehensive plans and ordinances to implement them.
    - Floodplain Land Use Assistance Program, which provides grants and technical assistance to improve management of floodplain lands.
    - Community Revitalization Program, which provides grant funds to support local initiatives that promote social and economic diversity to ensure a productive tax base and good quality of life.
    - The Growing Green Plus Grants Program is an extension to the Growing Greener Grant Program administered by the PA DEP. Programs covered with these funds are: Growing Greener Watershed Restoration and Protection, Surface Mining Conservation and Reclamation Act Bond Forfeiture, and Abandoned Mine Drainage Set-Aside Grants.
    - The Environmental Education grant administered by the PA DEP was established by the Environmental Education Act of 1993, which mandates that five percent of all pollution fines and penalties collected annually be set aside for environmental education.
    - The Alternative Fuels Incentive Grant (AFIG) Program was established by the PA DEP in 1992 under Act 166. This program provides funding to create new markets for alternative fuels in Pennsylvania. Municipalities and agencies are eligible to apply for grant funding for alternative fuels through this grant program.
    - Pennsylvania Infrastructure Investment Authority (PennVEST) administers a low interest loan and grant program for new construction or improvements to publicly or privately-owned drinking water, storm water, or sewage treatment facilities, as well as non-point source pollution prevention best management practices (BMPs).
    - DCNR administers Community Conservation Partnerships Program Grants. This program is funded with a variety of state and federal funding sources, including the Keystone Recreation, Park and Conservation Fund (Key 93) which encompasses several environmental and conservation related funds.
    - DCED manages the PA Small Water and Sewer Grant which funds small water, sewer, storm sewer, and flood control infrastructure projects. Funding is made available by the Commonwealth Financing Authority.

- Federal Government programs including:
    - Hazard Mitigation Assistance Programs, which provide grants for cost-effective mitigation projects either in the absence of a disaster or after a disaster declaration has occurred:
        - Flood Mitigation Assistance Program (FMA)
        - Hazard Mitigation Grant Program (HMGP)
        - The Building Resilient Infrastructure and Communities (BRIC) Program is a new funding program that will support states, local communities, tribes, and territories undertake hazard mitigation projects. BRIC is replacing the existing Pre-Disaster Mitigation (PDM) program that was previously housed under HMA programs.
    - Community Development Block Grants (CDBG), which provides funds to address a wide range of community development needs, including community development activities directed toward revitalizing neighborhoods, economic development, and providing improved community facilities and services. CDBG funds may be used for activities such as acquisition of real property; relocation and demolition; rehabilitation of residential and non-residential structures; and construction of public facilities and improvements to facilities such as water, sewer, and streets. There is an extra CDBG fund set aside for post-disaster recovery costs.
    - Small Communities Program Fund, which supports water quality infrastructure projects.
    - Weatherization Assistance Program, which enables low-income households to make their homes more energy efficient.
    - The Emergency Watershed Protection (EWP) Program is administered by the USDA Natural Resources Conservation Services to help communities quickly address serious and long-lasting damages to infrastructure and the environment. These funds are allocated soon after disasters to assist in with immediate recovery needs.
    - The Homeland Security Grant Program (HSPG) assists communities in implementing the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient Nation. The HSGP's allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery, including priorities towards preventing terrorism and enhancing state and major urban area fusion centers.
    - The Assistance to Firefighters Grant (AFG) administered by FEMA provides funds to help firefighters and other first responders obtain essential resources to protect the public and emergency responders in hazard events.

5.2.4. Education and Outreach

Education and outreach programs and methods are used to implement mitigation activities and communicate hazard-related information. Examples include fire safety programs that fire departments deliver to students at local schools; participation in community programs, such as Firewise Communities Certification or StormReady Certification and activities conducted as part of hazard awareness campaigns, such as Tornado or Flood Awareness Month. Some communities have their own public information or communications office to handle outreach

initiatives. A number of trainings, meetings and seminars relevant to hazard mitigation are coordinated annually by the Carbon County Emergency Management Agency. The following courses were open to all first responders of Carbon County as well as any other first responders from outside of Carbon County. These trainings were provided at no cost to the student or their sending agency. Courses provided in 2020 and 2021 include:

- Hazmat Awareness
- Hazmat Awareness Annual Refresher
- Hazmat Operations
- Hazmat Operations Annual Refresher
- Hazmat Technician Annual Refresher
- DECON Practices (Mass Decon & Technical Decon)
- FEMA G-317 (Community Emergency Response Teams)
- NIMS-700 (National Incident Management System
- NIMS-800 (National Response Framework)
- ICS-100 (Introduction to Incident Command)
- ICS-200 (Basic Incident Command System)
- ICS-300 (Incident Command for Expanding Incidents)
- ICS-400 (Advanced Incident Command for Command & General Staff)
- FEMA/PEMA G-402 – ICS Overview for Senior Officials
- PEMA-Duties & Responsibilities of the EMC (for Local EMCs)
- PEMA-Damage Reporting & Assessment (for Local EMCs)
- FEMA G-290 (Basic PIO)
- FEMA G-386 (Mass Fatality Incident Response)

5.2.5. Plan Integration

Plan integration recognizes that hazard mitigation is most effective when it works in concert with other plans, regulations, and programs. Per FEMA, plan integration is described as the regular consideration and management of hazard risks in a community's existing planning framework. The planning framework is the collection of plans, policies, codes, and programs that guide land use and development, how those are maintained and implemented, and the roles of a range of stakeholders to evaluate and update them. Effective integration of hazard mitigation occurs when the planning framework fosters development that does not increase risks from known hazards or leads to redevelopment that reduces risk from known hazards (FEMA, 2013).

In Pennsylvania, integrating hazard mitigation into planning tools is afforded through the Municipalities Planning Code in that protecting and promoting safety and health is a purpose of the code. Further, a purpose of the Municipalities Planning Code is "to minimize such problems as may presently exist or which may be foreseen", which is the focus of hazard mitigation planning.

When developing the HMP, certain sections of the County Comprehensive Plan, EOP, and various land use ordinances and regulations provided key information. Moving forward, each of these documents should not be treated as unrelated and updated separately. The County and each participating municipality are responsible for incorporating the specific mitigation actions recommended in this Plan into the necessary planning documents, including the

appropriate comprehensive plan, the County EOP, and any land use ordinances and regulations.

For example, zoning and other land use regulations can be amended to reflect the newly identified hazard areas, to ensure that development in those areas is minimized or at least conducted in a way that otherwise mitigates against the effects of hazards (e.g., requiring structures built in the floodplain to be elevated). As proposed changes to building codes are presented, their potential for mitigating damage due to hazards will be examined, and the changes will only be adopted if they are shown to lower risk. Changes to stormwater management plans will incorporate identified mitigation actions and will encourage increased participation in the NFIP.

Plan integration is not only accomplished through the MPC and planning tools such as comprehensive plans and zoning ordinances, but through capital improvement planning, area plans such as highway corridors and downtown plans, functional plans like stormwater and open space plans, and public and stakeholder outreach and education. This section highlights key opportunities for plan integration in Carbon County.

5.2.5.1. Comprehensive Plans

Carbon County's current Comprehensive Plan & Greenway Plan was adopted on November 21, 2013 by the Carbon County Board of Commissioners. The Plan provides a general direction and blueprint for the future of Carbon County and constituent communities, particularly as it pertains to resource preservation and land conservation. For example, the Plan recommends specific land use and development regulations and provides model ordinance provisions that could be used to preserve open space and greenways in the County. In regard to floodplain management, these recommendations go above and beyond minimum federal requirements and suggest that in some areas of the County, municipalities consider prohibiting new development within the 100-yr floodplain. The Plan also identifies key areas for conservation and greenway enhancements, such as wayfinding signage that could reduce the County's vulnerability to disorientation.

With regard to hazard mitigation planning, Section 301(a)2 of the MPC requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the Plan give consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services, and recommends giving consideration to storm drainage and floodplain management. The 2013 Comprehensive Plan and Greenway Plan considers findings from the 2010 HMP and future updates and improvements will continue to incorporate HMP findings.

Two multi-municipal comprehensive plans were developed to address specific issues and characteristics of the Central Region (Franklin, East Penn and Mahoning Townships, and Weissport and Lehighton Boroughs) and the Middle Region (Penn Forest Township, and Jim Thorpe, Summit Hill and Lansford Boroughs). Also, several jurisdictions in the County have local municipal comprehensive plans and include: Beaver Meadows, East Side, Nesquehoning, and Weatherly Boroughs and Kidder, Lausanne, and Lehigh Townships. County governments are required by law to adopt a comprehensive plan, while local municipalities may do so at their option. All municipalities in Carbon County are covered, in some capacity, under the county or a regional or local comprehensive plan.

5.2.5.2. Transportation Plans

The Northeastern Pennsylvania Alliance (NEPA) Metropolitan Planning Organization (MPO) developed the 2045 Long-Range Transportation Plan (LRTP) for several northeastern Pennsylvania counties including Carbon County (NEPA, 2020). The plan assesses the existing conditions of the transportation network in northeastern Pennsylvania, forecasts current and future needs, and identifies strategic directions for regional prioritization. The plan does not specifically address hazard mitigation planning; however, there are segments of the plan that relate to hazard mitigation, such as goals enhancing road safety and hazard reduction. The environmental analysis section of the LRTP discusses the MPO's process for evaluating the potential impacts of on community and environmental resources. When impacts are unavoidable, the NEPA MPO and project sponsors focus on minimizing and mitigating potential impacts of transportation projects, such as through coordination with local resource agencies and educating candidate project sponsors about environmental mitigation strategies.

While this plan was recently adopted, there are several opportunities to integrate hazard mitigation principles and actions in the next update. Important additions can include an inventory of vulnerable transportation assets, a comprehensive group of evacuation routes, and ways hazards may potentially impact the County's transportation system. Further, the environmental impact section could be expanded to describe how reducing impacts on the environment can mitigate some hazards. For example, stormwater management improvements not only reduce pollution in nearby waterways, but also the impacts of flooding from impervious surfaces. Hazard mitigation actions also help to preserve existing transportation infrastructure. The integration of actions from the 2021 HMP Update will ensure projects are prioritized for the LRTP, allowing for opportunity to integrate and align the strategic directions of the long-range transportation plan with hazard mitigation goals and actions.

5.2.6. Existing Limitations

As mentioned, there are no communities in Carbon County participating in the NFIP Community Rating System. However, 22 of the 23 municipalities in the County have been designated as floodprone. Community participation in this program can provide premium reductions for properties located outside of Special Flood Hazard Areas of up to 10 percent and reductions for properties located in Special Flood Hazard Areas of up to 45 percent. These discounts can be obtained by undertaking public information, mapping and regulations, flood damage reduction and flood preparedness activities (FEMA, 2009c).

Based on the capability assessment results, very few municipalities in the County have an adopted stormwater management plan or ordinance. A stormwater management plan is designed to address flooding associated with stormwater runoff. These plans typically focus on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding. Carbon County has an Act 167 Stormwater Management Plan which is a joint plan for Carbon and Schuylkill Counties covering the Nequehoning, Mauch Chunk, Mahoning, and Lizard Creek Watersheds. However, the plan was adopted in 1995 and has not been updated since. The presence of an updated stormwater management plan would greatly enhance mitigation capabilities needed to address flood and transportation hazards.

Numerous roads and intersections exist in the County where flooding issues repeatedly occur. Some of these roads and intersections are state routes. The County and local municipalities face challenges in mitigating flood events on state routes since these roads are owned and maintained by the Commonwealth of Pennsylvania. Local municipalities do not have the authority to independently carry out a mitigation project. In these situations, the Pennsylvania Department of Transportation must decide to undertake the project. Since the Department of Transportation is often most concerned with larger, critical transportation routes, smaller state roads and intersections which significantly affect a local community may not get the attention they need for the Commonwealth to take on a mitigation project.

As mentioned previously, several communities in Carbon County participate or up until recently have participated in the Firewise program. However, other communities in the County are identified as vulnerable to wildfire hazards. The Pennsylvania Firewise Community Program assists planned and existing communities in implementing management practices which reduce the risk of wildfire events. Firewise communities are those that avoid potential fire emergencies by addressing and correcting fire hazards and preparing for the threat of a wildfire event (DCNR-BOF, 2015a). Improved participation in this program will reduce the loss of lives, property and resources to wildfires by building and maintaining communities using practices that are compatible with their natural surroundings.

Finally, limited funding is a critical barrier to the implementation of hazard mitigation activities. The County will need to rely on regional, state and federal partnerships for financial assistance.

6. Mitigation Strategy

6.1. *Update Process Summary*

The mitigation strategy serves as the long-term road map to reduce the potential losses, vulnerabilities, and shortcomings identified in the Hazard Identification and Risk Assessment section. A typical mitigation strategy includes a list of goals and objectives, with mitigation actions to address the goals and objectives, that are then prioritized, based on the community's need.

Goals are long-term aspirations about the resiliency of the community given the potential effects of hazards. Objectives are measurable strategies that the Carbon County community has determined will be necessary to move closer to attaining each goal. Actions are the tasks that are proposed for realizing each objective.

There were 5 goals and 15 objectives identified in the 2015 Carbon County Hazard Mitigation Plan Update. The Steering Committee reviewed goals and objectives during a Steering Committee Review Meeting on October 23, 2020. The review of the goals and objectives is summarized below in Table 6.1-1.

TABLE 6.1-1 LIST AND REVIEW SUMMARY OF 2015 MITIGATION STRATEGY GOALS AND OBJECTIVES.

GOAL 1: Reduce vulnerability including loss of life and damage to assets from natural hazards.	
Objective 1A: Identify and evaluate potential protection measures for existing critical facilities with the highest relative vulnerability in the 1 percent annual chance floodplain.	Review: The HMPT agreed that this goal should be combined with Goal 4 and continued into the 2021 plan. Objectives

Objective 1B: Ensure that existing drainage systems such as pipes, culverts and channels are adequate and functioning properly.	1A, 1B, 1C, 1D, 1E, 4A (1F), and 4B (1G) have been continued into the 2021 plan under Goal 1. The HMPT added a new objective under Goal 1. Objective 1H focuses on the rehabilitation of high hazard potential dams.
Objective 1C: Evaluate the means of managing stranded travelers during the winter storms.	
Objective 1D: Reduce wildfire potential through planning and outreach.	
Objective 1E: Implement structural projects to reduce the impacts from flooding.	
GOAL 2: Increase Public Awareness regarding natural and manmade hazard risks, preparedness and mitigation.	
Objective 2A: Promote partnerships between the municipalities and the County to continue to develop a County-wide approach to identifying and implementing mitigation actions.	**Review:** The HMPT agreed that this goal should be continued into the 2021 plan. Objectives 2A and 2B have been continued into the 2021 plan.
Objective 2B: Provide public education to increase awareness of hazards and opportunities for mitigation.	
GOAL 3: Improve emergency warning and response procedures and capabilities.	
Objective 3A: Provide residents with adequate warning of potential floods and other weather related events.	**Review:** The HMPT agreed that this goal should be continued into the 2021 plan. Objectives 3A, 3B, 3C, and 3D have been continued into the 2021 plan. The HMPT added a new objective under Goal 3. Objective 3E focuses on outreach about the risks of drowning.
Objective 3B: Ensure that emergency response services and critical facilities functions are not interrupted or are minimally interrupted by natural hazards.	
Objective 3C: Improve coordination and communication disaster response organizations, emergency management entities, and local and county governments.	
Objective 3D: Increase awareness by residents (i.e. through public outreach/education) of actions to take during an emergency.	
GOAL 4: Protect existing natural resources.	
Objective 4A: Ensure the adequacy of erosion and sedimentation control practices throughout the County.	**Review:** The HMPT agreed that this goal should be combined with Goal 1 and continued into the 2021 plan. Objectives 4A and 4B have been continued into the 2021 plan under Goal 1.
Objective 4B: Work to preserve steeply sloping areas, sinkhole areas, floodplains, wetlands, etc.	
GOAL 5: Promote disaster-resistant future development and increase participation in the NFIP.	
Objective 5A: Encourage and facilitate the development or revision of comprehensive plans and zoning, land-use and floodplain management ordinances to consider limiting development in high-hazard areas.	**Review:** The HMPT agreed that this goal should be continued into the 2021 plan with an addition of the word 'sustainable.' Objectives 5A and 5B have been continued into the 2021 plan.
Objective 5B: Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.	

Mitigation actions have been carried over and developed for the County as well as for each participating jurisdiction. While some actions may be more general in nature and could apply to more than one jurisdiction, most actions are specific to individual jurisdictions. The mitigation actions that were developed were based on the following: issues identified in the Hazard Identification and Risk Assessment, gaps identified in the mitigation capability analysis,

input from the HMPT, and feedback from the Risk Assessment and Mitigation Solutions Workshop held November 18, 2020. These mitigation actions may be implemented through a variety of local tools such as: changes in ordinances and policies, inclusion into capital improvements budgets, and grant funding.

County and Municipal actions in the 2015 Plan were distributed at the November 2020 Mitigation Solutions workshop for review and update. Each action has been assigned one of the following categories:

- "Completed" – Actions that were completed since the adoption of the 2015 Plan
- "Cancelled" – Actions that were terminated.
- "Deferred" – Actions that had not been initiated since the adoption of the 2015 Plan
- "On-Going" – Actions that are performed on a regular and continuous basis by the department

The majority of existing mitigation actions have been carried over into the 2021 Hazard Mitigation Plan as they are continuous actions or actions that were not completed. A list of these actions as well as their status is included in Table 6.1-2. Actions were evaluated by the HMPT and municipal officials with the intent of producing a usable mitigation action plan in 2021 with actions and projects that could be completed over the next five years. This evaluation included a cost-benefit review and prioritization exercise, which is described in more detail in Section 6.4. Appendix C contains a summary of responses provided by municipalities to the *Mitigation Action Progress Report Form.*

TABLE 6.1-2 REVIEW OF 2015 ACTION PLAN

ACTION #	ACTION	MUNICIPALITY	REVIEW
1	Complete Lime Street in order to provide emergency access to Meadowcrest Subdivision.	Bowmanstown Borough	Completed.
2	Provide emergency generators at multiple facilities which can afford shelter during an emergency.	Lehighton Borough	Ongoing.
3	Build another bridge across Hazle Creek in the Borough in order to provide an emergency access route in the event the current bridge over Hazle Creek becomes damaged or unusable.	Weatherly Borough	Action ongoing, Borough applied for a state grant to complete this project.
4	Conduct youth outreach campaign aimed at existing hazard and hazard mitigation education.	Mahoning Township	Ongoing.
5	Hold public forum to educate public about types of hazard mitigation that can be done on an individual basis.	Carbon County and all municipalities	Ongoing. Carbon County organizes the CERT. All municipalities will participate in this action.
6	Identify critical transportation arteries and evaluate means to open roads for emergency access.	Carbon County and all municipalities	Ongoing.

ACTION #	ACTION	MUNICIPALITY	REVIEW
7	After a flood event or windstorm provide information on alternatives to reconstruction of structures that sustain damages more than or equal to 50% of value to property owners.	Carbon County and all municipalities	Deferred.
8	Work with County Tax Assessor and GIS Department to complete detailed mapping initiative to incorporate parcel and zoning information into countywide dataset.	Carbon County and all municipalities	Ongoing.
9	Install flood gates at Tippets Dam.	Jim Thorpe Borough, Nesquehoning Borough	Ongoing.
10	Foster increased cooperation and communication between Carbon County and the four significant out-of-county high-hazard dams that could impact Carbon through education, outreach, and dam failure scenarios or exercises, as appropriate.	Carbon County and all municipalities	Ongoing.
11	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.	All municipalities	Ongoing for all municipalities. Deferred by East Side Borough. Franklin Township will put this information on their website.
12	Conduct low level benefit-cost analysis to determine most appropriate project solution to flooding of homes on those streets previously identified as having high vulnerability to flooding.	East Side Borough	Ongoing. Borough notes there are no homes in the floodplain.
13	Replace pipes and re-grade Rhume Run from the mouth at Nesquehoning Creek to the headwaters.	Nesquehoning Borough	Ongoing.
14	Extend pipe at Franklin and Fireline Road culvert to the stream in order to prevent flooding.	Bowmanstown Borough	Ongoing.
15	Increase the culvert/pipe sizes at identified problem sites.	East Penn Township	Ongoing.
16	Continue to provide property owners information on how to obtain flood insurance from the NFIP.	All municipalities	Completed by Bowmanstown Borough. Deferred by East Side Borough. Ongoing for all other municipalities. Franklin Township will put this information on their website.
17	Raise SR 895 at known vulnerable sections.	East Penn Township	Ongoing.

ACTION #	ACTION	MUNICIPALITY	REVIEW
18	Evaluate the inclusion of more restrictive floodplain management requirements in floodplain management ordinance in those communities showing increased population and development trends.	Franklin Township, Kidder Township, Lausanne Township, Penn Forest Township, Towamensing Township	Ongoing. Deferred by Franklin Township; the floodplain ordinance in the municipality was adopted in 2002. They will consider updating this while proceeding on this action.
19	Install storm drains on Germans Road at identified location to prevent flooding.	East Penn Township	Ongoing.
20	Install/replace/repair culverts previously identified as problem areas Borough-wide.	Jim Thorpe Borough	Ongoing.
21	Undertake stormwater management in the Borough.	Jim Thorpe Borough	Ongoing.
22	Dredge Panther Creek near Edgemont Road and Oak Streets and along Dock Street area.	Lansford Borough	Ongoing.
23	Install new storm water collection drains to stormwater system at previously identified locations.	Lansford Borough	Ongoing.
24	Re-grade and repair 23 additional stormwater inlet culverts.	Lansford Borough	Ongoing.
25	Perform flood control along South and North Stagecoach Roads.	Lausanne Township	Ongoing.
26	Clean streets and protect piers and abutments of various bridges and culverts within the Borough to prevent flooding and/or structure failure.	Lehighton Borough	Ongoing.
27	Construct adequate culvert in Gypsy Hill Road.	Lehighton Borough	Ongoing.
28	Clean and repair catch basins and stormwater controls throughout community to eliminate local flooding.	Lehighton Borough, Mahoning Township	Ongoing.
29	Redirect water from Hunter's Creek to the Buckwha Creek in order to alleviate flooding problems.	Lower Towamensing Township	Ongoing.
30	Dredge the 1,000 feet of the Aquashicola Creek that currently remain undredged from the 1998 Army Corps dredging project.	Lower Towamensing Township	Ongoing.
31	Widen obsolete narrow bridges on township and state roads which cross various small streams and restrict water passage during high water conditions.	Mahoning Township	Ongoing.
32	Remove gravel bars, vegetation and silt deposits from Nesquehoning Creek from the Jim Thorpe-Nesquehoning Borough Line to Tippets Dam.	Nesquehoning Borough	Ongoing.
33	Replace pipes and construct a stormwater collection system along SR 54 to prevent flooding.	Nesquehoning Borough	Ongoing.
34	Repair storm drains that collapse due to flooding or washing out of roads during storms.	Summit Hill Borough	Ongoing.

ACTION #	ACTION	MUNICIPALITY	REVIEW
35	Increase the height of the banks of Hazle Creek that runs through the Borough's downtown.	Weatherly Borough	Ongoing.
36	Divert stormwater from SR 4006 at identified problem area to storm sewer system to Hazle Creek.	Weatherly Borough	Ongoing.
37	Install a storm sewer system to control stormwater from High Street, Jefferson Street, Franklin Street, and Dunningan Street.	Weatherly Borough	Ongoing.
38	Elevate Blue Mountain Road (road to fire department).	East Penn Township	Ongoing.
39	Map location of pipes, culverts and channels and perform routine maintenance.	Franklin Township	Ongoing. The Township Engineer, Carbon Engineering Inc., is working on this in conjunction with the Township's MS4 Permit.
40	Mitigate flood damage to 3 critical facilities located within the 1% annual-chance floodplain.	Weissport Borough	Ongoing.
41	Install retaining walls or overflow systems to divert stormwater flowing from the old water reserve dam located on the mountain north of the Borough, under the railroad tracks to the Hazle Creek. This will prevent flooding of the electric substation.	Weatherly Borough	Ongoing.
42	Correct water run-off problems on various Township roads to prevent washouts during heavy rains.	Franklin Township	Ongoing. Drainage improvement projects on Red Hill Road and Evergreen Road are underway.
43	Re-build road shoulder and install retaining walls at stream crossings where shoulders and guardrails have been routinely washed out.	Mahoning Township	Ongoing.
44	Correct water run-off problems within other areas of the Borough to prevent washouts of roads during storms.	Summit Hill Borough	Ongoing.
45	Re-grading and repair of hillside, adjacent to pool pump house at rear of Lansford Pool.	Lansford Borough	Ongoing.
46	Install a ¼ mile section of guardrail along the west side of White Street (heading toward Palmerton) in order to provide driver and pedestrian safety.	Bowmanstown Borough	Completed.
47	Install traffic lights and other necessary traffic control devices at high accident intersections.	Mahoning Township	Ongoing.
48	Trim trees along roads electrical distribution system to prevent power outages during storms.	Jim Thorpe Borough, Lansford Borough, Lehighton Borough, Mahoning Township, Packer	Ongoing. Weatherly Borough notes this process is done periodically in their municipality.

ACTION #	ACTION	MUNICIPALITY	REVIEW
		Township, Penn Forest Township, Summit Hill Borough, Weatherly Borough	
49	Clear large trees adjacent to PPL power lines on Summer Mountain Road.	Lower Towamensing Township	Ongoing.
50	Improve access to electric transmission line along the Lehigh River.	Lehighton Borough	Ongoing.
51	Purchase of an emergency generator to operate raw water pump station.	Lehighton Borough	Ongoing.
52	Configure the internal wiring of the three wells that supply the Borough's water to accept a portable trailer type generator power in the event of an outage.	Weatherly Borough	Completed.
53	Install remaining dry hydrants at water's edge encompassing Lake Harmony.	Kidder Township	Ongoing. Township is installing these as a part of land development projects.
54	Target subdivisions and housing developments for Firewise program participation.	All municipalities	Canceled by Bowmanstown Borough. Deferred by Franklin Township. Ongoing for all other municipalities.
55	Designate fire lane in identified critical areas.	All municipalities	Canceled by Bowmanstown Borough. Deferred by Franklin Township. Ongoing for all other municipalities.
56	Utilize Fire House as storm shelter during winter storms.	Banks Township	Ongoing.
57	Repair and widen Packerton Dam Drive to correct a hazardous narrow road that accumulates water and ice.	Mahoning Township	Ongoing.
58	Develop plan for locating and sheltering stranded travelers during winter storms.	Carbon County	Completed.
59	Resurface portions of various streets and intersections.	Lansford Borough	Ongoing.
60	Remove large trees over power lines on Golf Road, south to the Palmerton Borough line.	Lower Towamensing Township	Ongoing.
61	Township Engineer will work with local communities to develop stormwater management plan.	Kidder Township	Ongoing.
62	Provide 2nd access to be used during emergency at Little Gap Estates.	Lower Towamensing Township	Ongoing.

ACTION #	ACTION	MUNICIPALITY	REVIEW
63	Replace/improve storm catches and lines in low lying and traffic areas.	Palmerton Borough	Ongoing.
64	Control flow of water along roadways.	Towamensing Township	Ongoing.

Mitigation Success

Progress has been made on a series of hazard mitigation projects and actions in the last five years. Details on numerous actions marked as "Completed" and "Ongoing" are summarized below:

- Bowmanstown Borough completed construction of Lime Street which now provides emergency access to the Meadowcrest Subdivision.
- Weatherly Borough applied for a state grant to complete the construction of another bridge across Hazel Creek in order to provide an emergency access route in the event that the existing bridge becomes damaged or unusable.
- Carbon County regularly organizes the Community Emergency Response Team (CERT) which holds public forums to educate the public about types of hazard mitigation that can be done on an individual basis.
- Municipalities conduct ongoing education to increase awareness of and participation in FEMA's NFIP and Community Rating System. Franklin Township will put this information on their website.
- Municipalities with increased population and development trends are evaluating the inclusion of more restrictive floodplain management requirements through floodplain management ordinances.
- Franklin Township is mapping the locations of pipes, culverts, and channels and performing routine maintenance in accordance with its MS4 Permit.
- Drainage improvement projects are underway in Franklin Township on Red Hill Road and Evergreen Road to correct water run-off problems and prevent washouts during heavy rains.
- Bowmanstown Borough installed a ¼ mile section of guardrail along the west side of White Street to increase pedestrian and driver safety.
- Weatherly Borough periodically trims trees along electrical distribution systems to prevent power outages during storms.
- Weatherly Borough configured the internal wiring for the wells that supply the Borough's water to accept a portable trailer type generator power in the event of an outage.
- Kidder Township is in the process of installing dry hydrants at the water's edge along Lake Harmony as part of land development processes.
- Carbon County developed a plan for locating and sheltering stranded travelers during winter storms.
- Local officials from Carbon County and many municipalities attended the FEMA G402 training on NIMS. Additional trainings have been offered in the county to meet NIMS requirements.

- Carbon County has organized free drive through flu vaccine clinics throughout the county for several years. COVID vaccine clinics were being organized during the 2021 Hazard Mitigation Plan update process.
- Additionally, two property acquisitions have been funded through the HMGP in Carbon County between 2014 and 2018. Both repetitive loss properties are located in Palmerton Borough and are single-family uses. Federal obligations exceeded $41,000 for these properties (PEMA, 2019).

6.2. *Mitigation Goals and Objectives*

Based on results of the review of the 2015 HMP mitigation goals and objectives established, a new set of goals and objectives were developed in 2020. Tables 6.1-1 explains how goals and objectives were updated and revised. Table 6.2-1 lists the mitigation goals and objectives established for the 2021 plan. There are 4 goals and 17 objectives identified.

TABLE 6.2-1 LIST OF MITIGATION STRATEGY GOALS AND OBJECTIVES.

GOAL 1	Protect lives, property, and natural resources in Carbon County.
Objective 1A	Identify and evaluate potential protection measures for existing critical facilities with the highest relative vulnerability in the 1-percent-annual-chance floodplain.
Objective 1B	Ensure that existing drainage systems such as pipes, culverts and channels are adequate and functioning properly.
Objective 1C	Evaluate the means of managing stranded travelers during the winter storms.
Objective 1D	Reduce wildfire potential through planning and outreach.
Objective 1E	Implement structural projects to reduce the impacts from flooding.
Objective 1F	Ensure the adequacy of erosion and sedimentation control practices throughout the County.
Objective 1G	Work to preserve steeply sloping areas, sinkhole areas, floodplains, wetlands, etc.
Objective 1H	Coordinate with High Hazard Potential Dam owners and affected officials on dam rehabilitation and funding.
GOAL 2	Increase Public Awareness regarding natural and humanmade hazard risks, preparedness and mitigation.
Objective 2A	Promote partnerships between the municipalities and the County to continue to develop a County-wide approach to identifying and implementing mitigation actions.
Objective 2B	Provide public education to increase awareness of hazards and opportunities for mitigation.
GOAL 3	Improve emergency warning and response procedures and capabilities.
Objective 3A	Provide residents with adequate warning of potential floods and other weather related events.
Objective 3B	Ensure that emergency response services and critical facilities functions are not interrupted or are minimally interrupted by natural hazards.

Objective 3C	Improve coordination and communication disaster response organizations, emergency management entities, and local and county governments.
Objective 3D	Increase awareness by residents (i.e., through public outreach/education) of actions to take during an emergency.
Objective 3E	Conduct public outreach on the vulnerabilities and risk factors of drowning.
GOAL 4	Promote sustainable, disaster-resistant future development and increase participation in the NFIP.
Objective 4A	Encourage and facilitate the development or revision of comprehensive plans and zoning, land-use and floodplain management ordinances to consider limiting development in high-hazard areas.
Objective 4B	Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.

6.3. *Identification and Analysis of Mitigation Techniques*

The mitigation strategy in the updated Hazard Vulnerability Assessment and Mitigation Plan Update should include analysis of a comprehensive range of specific techniques or actions. FEMA, through the March 2013 Local Mitigation Handbook, and PEMA, through the October 2020 Standard Operating Guide (SOG), identify four categories of hazard mitigation techniques.

- Local plans and regulations: Government authorities, policies, or codes that influence the way land and buildings are developed and built. Examples include, but are not limited to, comprehensive plans, subdivision regulations, building codes and enforcement, and NFIP and CRS.
- Structure and infrastructure: Modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. Examples include, but are not limited to, acquisition and elevation of structures in flood prone areas, utility undergrounding, structural retrofits, floodwalls and retaining walls, detention and retention structures, and culverts.
- Natural systems protection: Actions that minimize damage and losses and preserve or restore the functions of natural systems. Examples include, but are not limited to, sediment and erosion control, stream corridor restoration, forest management, conservation easements, and wetland restoration and preservation.
- Education and awareness: Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate the hazards and may also include participation in national programs. Examples include, but are not limited to, radio or television spots, websites with maps and information, provide information and training, NFIP outreach, StormReady, and Firewise Communities.

The HMPT reviewed the four types of mitigation techniques and examples of actions at the Risk Assessment and Mitigation Solutions Workshop. Table 6.3-1 provides a matrix identifying the mitigation techniques used for each hazard in the County. The specific actions associated with these techniques are included in Table 6.4-1.

TABLE 6.3-1 MITIGATION TECHNIQUES USED FOR EACH HAZARD IN CARBON COUNTY.

HAZARD	MITIGATION TECHNIQUE			
	LOCAL PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS
Building/Structure Collapse	X			
Civil Disturbance	X			X
Dam Failure	X	X		X
Disorientation	X	X		X
Drought	X	X		X
Drowning	X			X
Environmental Hazards - Coal Mining	X			
Flood, Flash Flood, Ice Jam	X	X	X	X
Hailstorm	X			
Hurricane, Tropical Storm, Nor'easter	X	X	X	X
Landslide	X	X	X	X
Levee Failure	X	X		X
Nuclear Incident	X	X		X
Pandemic and Infectious Disease	X			
Radon	X			
Transportation Accidents	X	X		X
Utility Interruption	X	X		X
Wildfire	X	X	X	X
Winter Storm	X	X		X

6.4. *Mitigation Action Plan*

A kick-off meeting for the 2021 Carbon County Hazard Mitigation Plan Update was held on August 19, 2020 to develop a framework for the plan. The goals and objectives were presented during this meeting. During the Risk Assessment and Mitigation Solutions Workshop on November 18, 2020, Mitigation Techniques were discussed using FEMA's *Mitigation Ideas* document. During the workshop, municipalities were provided their *Mitigation Action Progress Report Form* which listed their actions and projects from the 2015 HMP for review and update as described in Section 6.1. Actions that have been deferred or ongoing have been carried over to the 2021 Action Plan and are again proposed for implementation.

In addition, participants were given *Mitigation Action Forms* to provide any new actions or projects to be included in the plan update. Mitigation Action forms were also posted to the project website and sent out via email (or post if requested). Meeting participants who were not affiliated with a municipality were provided with *New Mitigation Action Forms* to include new mitigation actions in the 2021 plan if they so wished.

The final list of 69 mitigation actions is contained in Table 6.4-1. Nine of the total 67 actions are new actions for this 2021 update including three new actions related to dam failure and HHPDs which can all be linked to multiple mitigation goals identified above. This table provides an overview of the strategy that will be utilized in order to implement each of the

proposed mitigation actions. For each action listed in Table 6.4-1, the associated strategy identifies the agency or job title that will be responsible for initiating the work and potential sources of funding for the work. Each strategy also indicates a timeframe for when the action will happen. At least one mitigation action was established for each hazard in Carbon County. More than one action is identified for several hazards. Every participating jurisdiction has at least one mitigation action. The priority level and feasibility of each action follows in separate tables.

TABLE 6.4-1 2021 MITIGATION ACTION PLAN

ACTION NO: 1	Provide emergency generators at multiple facilities which can afford shelter during an emergency.
COMMUNITY: Lehighton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption
Lead Agency/Department:	Lehighton Borough
Implementation Schedule:	As funds becomes available
Funding Source:	FEMA/HMGP; PEMA
ACTION NO: 2	Build another bridge across Hazle Creek in the Borough in order to provide an emergency access route in the event the current bridge over Hazle Creek becomes damaged or unusable.
COMMUNITY: Weatherly Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Drought; Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption
Lead Agency/Department:	Weatherly Borough
Implementation Schedule:	5 years
Funding Source:	FEMA/HMGP; *Application for Grant funding has been submitted.
ACTION NO: 3	Conduct youth outreach campaign aimed at existing hazard and hazard mitigation education.
COMMUNITY: Mahoning Township	
Category:	Education and Awareness
Hazard(s) Addressed:	Drought; Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption
Lead Agency/Department:	Mahoning Township
Implementation Schedule:	Annually, ongoing
Funding Source:	HMGP, PEMA, County, Township

ACTION NO: 4	Hold public forum to educate public about types of hazard mitigation that can be done on an individual basis.
COMMUNITY: Carbon County and all municipalities	
Category:	Education and Awareness
Hazard(s) Addressed:	Drought; Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption
Lead Agency/Department:	Carbon County EMA
Implementation Schedule:	1 year
Funding Source:	FEMA/HMGP; PEMA, County
ACTION NO: 5	Identify critical transportation arteries and evaluate means to open roads for emergency access.
COMMUNITY: Carbon County and all municipalities	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Drought; Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption
Lead Agency/Department:	Carbon County EMA; Carbon County Office of Planning and Development
Implementation Schedule:	2 years.
Funding Source:	PennDOT, County
ACTION NO: 6	After a flood event or windstorm provide information on alternatives to reconstruction of structures that sustain damages more than or equal to 50% of value to property owners.
COMMUNITY: Carbon County and all municipalities	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure
Lead Agency/Department:	Carbon County EMA, Carbon County Office of Planning and Development
Implementation Schedule:	3 years.
Funding Source:	County; FEMA/HMGP
ACTION NO: 7	Work with County Tax Assessor and GIS Department to complete detailed mapping initiative to incorporate parcel and zoning information into countywide dataset.
COMMUNITY: Carbon County and all municipalities	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Drought; Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Disorientation; Nuclear Incidents; Transportation Accident; Utility Interruption

Lead Agency/Department:	Carbon County EMA, Carbon County Office of Planning and Development
Implementation Schedule:	5 years
Funding Source:	County
ACTION NO: 8	Install flood gates at Tippets Dam.
COMMUNITY: Jim Thorpe Borough, Nesquehoning Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Dam Failure; Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	DEP
Implementation Schedule:	As funds become available.
Funding Source:	DEP, FEMA/HMGP, PEMA
ACTION NO: 9	Foster increased cooperation and communication between Carbon County and the four significant out-of-county high-hazard dams that could impact Carbon through education, outreach, and dam failure scenarios or exercises, as appropriate.
COMMUNITY: Carbon County and all municipalities	
Category:	Education and Awareness
Hazard(s) Addressed:	Dam Failure; Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Carbon County EMA
Implementation Schedule:	3 years
Funding Source:	FEMA/HMGP; PEMA; DEP
ACTION NO: 10	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.
COMMUNITY: All municipalities in Carbon County	
Category:	Local Plans and Regulations; Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter
Lead Agency/Department:	Individual Municipalities
Implementation Schedule:	5 years
Funding Source:	Municipalities, County staff time.
ACTION NO: 11	Conduct low level benefit-cost analysis to determine most appropriate project solution to flooding of homes on those streets previously identified as having high vulnerability to flooding.
COMMUNITY: East Side Borough	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter

Lead Agency/Department:	East Side Borough
Implementation Schedule:	In progress; 3 years
Funding Source:	County staff time, Municipal staff time, FEMA/HMGP
ACTION NO: 12	Replace pipes and re-grade Rhume Run from the mouth at Nesquehoning Creek to the headwaters.
COMMUNITY: Nesquehoning Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	DEP; USACE
Implementation Schedule:	As funds become available.
Funding Source:	DEP; FEMA/HMGP; PEMA
ACTION NO: 13	Extend pipe at Franklin and Fireline Road culvert to the stream in order to prevent flooding.
COMMUNITY: Bowmanstown Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Bowmanstown Borough
Implementation Schedule:	Contingent upon obtaining final homeowner's approval for access
Funding Source:	DEP, PEMA, Municipality
ACTION NO: 14	Increase the culvert/pipe sizes at identified problem sites.
COMMUNITY: East Penn Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	East Penn Township
Implementation Schedule:	5 years
Funding Source:	East Penn Township; DEP, PEMA
ACTION NO: 15	Continue to provide property owners information on how to obtain flood insurance from the NFIP.
COMMUNITY: Banks Township, Beaver Meadows Borough, East Penn Township, East Side Borough, Franklin Township, Jim Thorpe Borough, Kidder Township, Lansford Borough, Lausanne Township, Lehigh Township, Lehighton Borough, Lower Towamensing Township, Mahoning Township, Nesquehoning Borough, Packer Township, Palmerton Borough, Parryville Borough, Penn Forest Township, Summit Hill Borough, Towamensing Township, Weatherly Borough, Weissport Borough	
Category:	Local Plans and Regulations; Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam

Lead Agency/Department:	Individual Municipality
Implementation Schedule:	Ongoing
Funding Source:	Municipalities
ACTION NO: 16	Raise SR 895 at known vulnerable sections.
COMMUNITY: East Penn Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	PENNDOT; East Penn Township
Implementation Schedule:	3 years
Funding Source:	PennDOT; East Penn Township
ACTION NO: 17	Evaluate the inclusion of more restrictive floodplain management requirements in floodplain management ordinances in those communities showing increased population and development trends.
COMMUNITY: Franklin Township, Kidder Township, Lausanne Township, Penn Forest Township, Towamensing Township	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Individual Municipalities
Implementation Schedule:	Ongoing
Funding Source:	Municipal staff time
ACTION NO: 18	Install storm drains on Germans Road at identified location to prevent flooding.
COMMUNITY: East Penn Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	East Penn Township
Implementation Schedule:	3 years
Funding Source:	East Penn Township; DEP; EPA
ACTION NO: 19	Install/replace/repair culverts previously identified as problem areas Borough-wide.
COMMUNITY: Jim Thorpe Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Jim Thorpe Borough

Implementation Schedule:	As funds become available.
Funding Source:	Jim Thorpe Borough; PEMA, DEP
ACTION NO: 20	Undertake stormwater management in the Borough.
COMMUNITY: Jim Thorpe Borough	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Jim Thorpe Borough
Implementation Schedule:	1 year
Funding Source:	Jim Thorpe Borough
ACTION NO: 21	Dredge Panther Creek near Edgemont Road and Oak Streets and along Dock Street area.
COMMUNITY: Lansford Borough	
Category:	Natural Systems Protection
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm & Nor'easter
Lead Agency/Department:	Lansford Borough; DEP, USACE
Implementation Schedule:	As funds become available.
Funding Source:	Lansford Borough; DEP, USACE
ACTION NO: 22	Install new storm water collection drains to stormwater system at previously identified locations.
COMMUNITY: Lansford Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Lansford Borough
Implementation Schedule:	As funds become available.
Funding Source:	Lansford Borough; DEP; EPA
ACTION NO: 23	Re-grade and repair 23 additional stormwater inlet culverts.
COMMUNITY: Lansford Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Lansford Borough
Implementation Schedule:	As funds become available.
Funding Source:	Lansford Borough; DEP; EPA
ACTION NO: 24	Perform flood control along South and North Stagecoach Roads.
COMMUNITY: Lausanne Township	
Category:	Structure and Infrastructure

Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Lausanne Township
Implementation Schedule:	In progress, some repair work done; 2 years
Funding Source:	FEMA/HMGP; PEMA; Township
ACTION NO: 25	Clean streets and protect piers and abutments of various bridges and culverts within the Borough to prevent flooding and/or structure failure.
COMMUNITY: Lehighton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Lehighton Borough
Implementation Schedule:	Repairs over Lehigh Drive Bridge and Bridge Street over Mahoning Creek in progress. Rip rap needs to be completed.
Funding Source:	Borough; County
ACTION NO: 26	Construct adequate culvert at Gypsy Hill Road.
COMMUNITY: Lehighton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Lehighton Borough
Implementation Schedule:	In progress, one of two culverts completed.
Funding Source:	Lehighton Borough; PennDOT; DEP
ACTION NO: 27	Clean and repair catch basins and stormwater controls throughout community to eliminate local flooding.
COMMUNITY: Lehighton Borough, Mahoning Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Individual Municipality
Implementation Schedule:	Annually
Funding Source:	Municipalities
ACTION NO: 28	Redirect water from Hunter's Creek to the Buckwha Creek in order to alleviate flooding problems.
COMMUNITY: Lower Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	USACE; FEMA
Implementation Schedule:	5 years +

Funding Source:	FEMA; DEP; EPA; USACE
ACTION NO: 29	Dredge the 1,000 feet of the Aquashicola Creek that currently remain undredged from the 1998 Army Corps dredging project.
COMMUNITY: Lower Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	USACE
Implementation Schedule:	As funds become available.
Funding Source:	USACE; DEP
ACTION NO: 30	Widen obsolete narrow bridges on township and state roads which cross various small streams and restrict water passage during high water conditions.
COMMUNITY: Mahoning Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Mahoning Township
Implementation Schedule:	As funds become available.
Funding Source:	FEMA/HMGP; PEMA; PennDOT
ACTION NO: 31	Remove gravel bars, vegetation and silt deposits from Nesquehoning Creek from the Jim Thorpe-Nesquehoning Borough Line to Tippets Dam.
COMMUNITY: Nesquehoning Borough	
Category:	Natural Systems Protection
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	DEP; Carbon County Conservation District
Implementation Schedule:	As funds become available.
Funding Source:	DEP; FEMA/HMGP; PEMA; Conservation District
ACTION NO: 32	Replace pipes and construct a stormwater collection system along SR 54 to prevent flooding.
COMMUNITY: Nesquehoning Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Nesquehoning Borough
Implementation Schedule:	As funds become available.
Funding Source:	Nesquehoning Borough; FEMA/HMGP; PEMA
ACTION NO: 33	Repair storm drains that collapse due to flooding or washing out of roads during storms.
COMMUNITY: Summit Hill Borough	

Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Summit Hill Borough
Implementation Schedule:	Annually
Funding Source:	Summit Hill Borough
ACTION NO: 34	Increase the height of the banks of Hazle Creek that runs through the Borough's downtown.
COMMUNITY: Weatherly Borough	
Category:	Natural Systems Protection
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	DEP; Weatherly Borough, Carbon County Conservation District
Implementation Schedule:	As funds become available
Funding Source:	FEMA/HMGP, DEP
ACTION NO: 35	Divert stormwater from SR 4006 at identified problem area to storm sewer system to Hazle Creek.
COMMUNITY: Weatherly Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Weatherly Borough, DEP
Implementation Schedule:	As funds become available.
Funding Source:	DEP
ACTION NO: 36	Install a storm sewer system to control stormwater from High Street, Jefferson Street, Franklin Street, and Dunningan Street.
COMMUNITY: Weatherly Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Weatherly Borough
Implementation Schedule:	As funds become available.
Funding Source:	Weatherly Borough
ACTION NO: 37	Elevate Blue Mountain Road (road to fire department).
COMMUNITY: East Penn Township	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	All Hazards
Lead Agency/Department:	East Penn Township; PennDOT
Implementation Schedule:	As funds become available.

Funding Source:	East Penn Township (staff time); FEMA/HMGP
ACTION NO: 38	Map location of pipes, culverts and channels and perform routine maintenance.
COMMUNITY: Franklin Township	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Franklin Township Public Works Department
Implementation Schedule:	2 years
Funding Source:	Township; DEP
ACTION NO: 39	Mitigate flood damage to three critical facilities located within the 1% annual-chance floodplain.
COMMUNITY: Weissport Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Weissport Borough
Implementation Schedule:	Ongoing; 1 year
Funding Source:	Borough and County staff time
ACTION NO: 40	Install retaining walls or overflow systems to divert stormwater flowing from the old water reserve dam located on the mountain north of the Borough, under the railroad tracks to the Hazle Creek. This will prevent flooding of the electric substation.
COMMUNITY: Weatherly Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Dam Failure; Utility Interruption
Lead Agency/Department:	Weatherly Borough
Implementation Schedule:	1 year.
Funding Source:	FEMA/HMGP, PEMA; USACE; DEP
ACTION NO: 41	Correct water run-off problems on various Township roads to prevent washouts during heavy rains.
COMMUNITY: Franklin Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Transportation Accident
Lead Agency/Department:	Franklin Township Public Works Department
Implementation Schedule:	Ongoing
Funding Source:	FEMA/HMGP; PEMA
ACTION NO: 42	Re-build road shoulder and install retaining walls at stream crossings where shoulders and guardrails have been routinely washed out.

COMMUNITY: Mahoning Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Transportation Accident
Lead Agency/Department:	Mahoning Township
Implementation Schedule:	Ongoing; Re-built shoulders and paved shoulders on various roads within the Township.
Funding Source:	Mahoning Township
ACTION NO: 43	Correct water run-off problems within other areas of the Borough to prevent washouts of roads during storms.
COMMUNITY: Summit Hill Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Transportation Accident
Lead Agency/Department:	Summit Hill Borough
Implementation Schedule:	Annually
Funding Source:	Summit Hill Borough
ACTION NO: 44	Re-grade and repair hillside, adjacent to pool pump house at rear of Lansford Pool.
COMMUNITY: Lansford Borough	
Category:	Structure and Infrastructure; Natural Systems Protection
Hazard(s) Addressed:	Landslide
Lead Agency/Department:	Lansford Borough; Carbon County Conservation District
Implementation Schedule:	As funds become available.
Funding Source:	Lansford Borough; DCNR
ACTION NO: 45	Install traffic lights and other necessary traffic control devices at high accident intersections.
COMMUNITY: Mahoning Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Transportation Accident
Lead Agency/Department:	Mahoning Township
Implementation Schedule:	Ongoing; New traffic light at Normal Square and four-way stop at New Mahoning Intersection.
Funding Source:	Mahoning Township
ACTION NO: 46	Trim trees along roads electrical distribution system to prevent power outages during storms.
COMMUNITY: Jim Thorpe Borough, Lansford Borough, Lehighton Borough, Mahoning Township, Packer Township, Penn Forest Township, Summit Hill Borough, Weatherly Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption

Lead Agency/Department:	PPL
Implementation Schedule:	Ongoing
Funding Source:	PPL; Municipalities
ACTION NO: 47	Clear large trees adjacent to PPL power lines on Summer Mountain Road.
COMMUNITY: Lower Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Lower Towamensing Township
Implementation Schedule:	As funds become available.
Funding Source:	Lower Towamensing Township
ACTION NO: 48	Improve access to electric transmission line along the Lehigh River.
COMMUNITY: Lehighton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Lehighton Borough
Implementation Schedule:	2 years
Funding Source:	PPL; County
ACTION NO: 49	Purchase an emergency generator to operate raw water pump station.
COMMUNITY: Lehighton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Lehighton Borough Water Authority
Implementation Schedule:	As funds become available.
Funding Source:	FEMA/HMGP/EMPG; Borough Water Authority
ACTION NO: 50	Install remaining dry hydrants at water's edge encompassing Lake Harmony.
COMMUNITY: Kidder Township	
Category:	Structure and Infrastructure ; Natural Systems Protection
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Kidder Township
Implementation Schedule:	As funding becomes available
Funding Source:	FEMA/HMGP; PEMA

ACTION NO: 51	Target subdivisions and housing developments for Firewise program participation.
COMMUNITY: Banks Township, Beaver Meadows Borough, East Penn Township, East Side Borough, Franklin Township, Jim Thorpe Borough, Kidder Township, Lansford Borough, Lausanne Township, Lehigh Township, Lehighton Borough, Lower Towamensing Township, Mahoning Township, Nesquehoning Borough, Packer Township, Palmerton Borough, Parryville Borough, Penn Forest Township, Summit Hill Borough, Towamensing Township, Weatherly Borough, Weissport Borough	
Category:	Local Plans and Regulations; Natural Systems Protection
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	DCNR; County
Implementation Schedule:	5 year rotation for hazard fuel mitigation projects; Annually for public education projects and training; Three years for updates on Emergency Action Plans
Funding Source:	U.S. Forest Service; DCNR
ACTION NO: 52	Designate fire lane in identified critical areas.
COMMUNITY: Banks Township, Beaver Meadows Borough, East Penn Township, East Side Borough, Franklin Township, Jim Thorpe Borough, Kidder Township, Lansford Borough, Lausanne Township, Lehigh Township, Lehighton Borough, Lower Towamensing Township, Mahoning Township, Nesquehoning Borough, Packer Township, Palmerton Borough, Parryville Borough, Penn Forest Township, Summit Hill Borough, Towamensing Township, Weatherly Borough, Weissport Borough	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Carbon County Office of Planning and Development; Municipal Planning Departments and Municipal Supervisors
Implementation Schedule:	1 year
Funding Source:	PennDOT; County; Municipalities
ACTION NO: 53	Utilize Fire House as storm shelter during winter storms. Make shelter ready.
COMMUNITY: Banks Township	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Winter Storm
Lead Agency/Department:	Banks Township
Implementation Schedule:	1 year
Funding Source:	FEMA/HMGP
ACTION NO: 54	Repair and widen Packerton Dam Drive to correct a hazardous narrow road that accumulates water and ice.
COMMUNITY: Mahoning Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Winter Storm; Transportation Accidents

Lead Agency/Department:	Mahoning Township
Implementation Schedule:	As funds become available.
Funding Source:	FEMA/HMGP; PEMA
ACTION NO: 55	Resurface portions of various streets and intersections.
COMMUNITY: Lansford Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Transportation Accidents
Lead Agency/Department:	Lansford Borough; PennDOT
Implementation Schedule:	As funds become available.
Funding Source:	Lansford Borough
ACTION NO: 56	Remove large trees over power lines on Golf Road, south to the Palmerton Borough line.
COMMUNITY: Lower Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Lower Towamensing Township; PPL
Implementation Schedule:	As funds become available.
Funding Source:	PPL; Lower Towamensing Township
ACTION NO: 57	Work with local communities to develop stormwater management plan.
COMMUNITY: Kidder Township	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	Kidder Township
Implementation Schedule:	As funds become available.
Funding Source:	Township
ACTION NO: 58	Provide 2nd access to be used during emergency at Little Gap Estates.
COMMUNITY: Lower Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Wildfire; Winter Storm; Dam Failure; Nuclear Incidents; Transportation Accident
Lead Agency/Department:	Lower Towamensing Township
Implementation Schedule:	5 years

Funding Source:	HMGP; DCNR-BOF
ACTION NO: 59	Replace/improve storm catches and lines in low lying and traffic areas.
COMMUNITY: Palmerton Borough	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Transportation Accident, Utility Interruption
Lead Agency/Department:	Palmerton Borough
Implementation Schedule:	5 years
Funding Source:	DEP
ACTION NO: 60	Control flow of water along roadways.
COMMUNITY: Towamensing Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Hurricane, Tropical Storm, & Nor'easter; Landslide; Transportation Accident
Lead Agency/Department:	Towamensing Township
Implementation Schedule:	3 years
Funding Source:	Township
ACTION NO: 61	Invite stakeholders to form a River Task Force to address increased number of rescues that have occurred within County waterways.
COMMUNITY: Carbon County	
Category:	Education and Awareness
Hazard(s) Addressed:	Drowning
Lead Agency/Department:	Carbon County Emergency Management Agency
Implementation Schedule:	1 year
Funding Source:	County
ACTION NO: 62	Continue to offer flu and other infectious disease vaccination clinics to residents, ensuring access by vulnerable populations.
COMMUNITY: Carbon County	
Category:	Education and Awareness, Local Plans and Regulations
Hazard(s) Addressed:	Pandemic
Lead Agency/Department:	Carbon County Emergency Management Agency, Carbon County Department of Health
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 63	Increase frequency of National Incident Management System (NIMS), Incident Command System (ICS), and Crowd Control trainings for County and local law enforcement.

COMMUNITY: Carbon County and all municipalities	
Category:	Education and Awareness
Hazard(s) Addressed:	Civil Disturbance
Lead Agency/Department:	Count Sheriff's Office, Carbon County Emergency Management Agency, District Attorney's Office
Implementation Schedule:	Ongoing
Funding Source:	County and Municipal Operating budgets
ACTION NO: 64	Work with Northeast Regional Terrorism Taskforce to purchase additional equipment for civil disturbance incidents.
COMMUNITY: Carbon County	
Category:	Education and Awareness, Local Regulations
Hazard(s) Addressed:	Civil Disturbance
Lead Agency/Department:	Carbon County Emergency Management Agency, Northeast Regional Taskforce
Implementation Schedule:	2 years
ACTION NO: 64	Work with Northeast Regional Terrorism Taskforce to purchase additional equipment for civil disturbance incidents.
Funding Source:	County
ACTION NO: 65	Obtain grant funding for the acquisition, demolition, demolition/reconstruction, relocation, and/or elevation of structures that are vulnerable to flooding.
COMMUNITY: Carbon County and all municipalities	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Carbon County Emergency Management Agency in coordination with municipalities, Carbon County Office of Planning and Development
Implementation Schedule:	5 years
Funding Source:	HMGP
ACTION NO: 66	Evaluate the risk and hazard of wildland fire to the communities of Carbon County by developing a Hazard Fuel Reduction Program for the most "at-risk' communities; educating and training first responders to better handle large scale incidents, evaluating the social and economic impact of a catastrophic wildfire to communities, and form a stakeholder group to develop a county-wide wildland fire mitigation plan.
COMMUNITY: Carbon County and all municipalities	
Category:	Education and Awareness, Local Regulations
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Pennsylvania Bureau of Forestry, Carbon County Emergency Management Agency
Implementation Schedule:	2 years
Funding Source:	Staff time of County and PA Bureau of Forestry

ACTION NO: 67	Ensure critical facilities list for the County and all municipalities remains current and accurate.
COMMUNITY: Carbon County and all municipalities	
Category:	Local Regulations
Hazard(s) Addressed:	All Hazards
Lead Agency/Department:	Carbon County Emergency Management Agency, Carbon County GIS
Implementation Schedule:	Yearly
Funding Source:	Staff time of County and Municipalities
ACTION NO: 68	Identify dam-related deficiencies and determine the best approach to address them.
COMMUNITY: Carbon County and all municipalities	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Dam Failure, Flood, Flash Flood, and Ice Jam
Lead Agency/Department:	Carbon County Emergency Management Agency, PADEP, identified dam owners
Implementation Schedule:	Yearly
Funding Source:	Staff time of County
ACTION NO: 69	Provide notice of funding opportunity and supporting documentation from the County HMP to EMCs and the municipality with High Hazard Potential Dams to promote rehabilitation and safety in Centre County.
COMMUNITY: Carbon County and all municipalities	
Category:	Education and Awareness
Hazard(s) Addressed:	Dam Failure (HHPD)
Lead Agency/Department:	Carbon County Emergency Management Agency
Implementation Schedule:	Annually by December (grant applications due June each year)

Many of these mitigation actions will require substantial time commitments from staff at the County and local municipalities. While all these activities will be pursued over the next five years, the reality of limited time and resources requires the identification of the feasibility and priority level of mitigation actions. Prioritization allows the individuals and organizations involved to focus their energies and ensure progress on mitigation activities.

Evaluating mitigation actions involves judging each action against certain criteria to determine its feasibility and potential impact. Actions evaluated and prioritized by applying the Multi-Objective Mitigation Action Prioritization criteria. For each action, scores were 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.
- Addresses High Risk Hazard (weight: 15% of score): The action reduces vulnerability for people and property from a hazard(s) identified as high risk.
- Addresses 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, data circuits, etc.

Scores of 1, 2, or 3 were assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. The Efficiency criterion, which considers the cost and effort of each action versus its overall vulnerability reduction benefit, is the most highly weighted criterion as part of the total prioritization score. Actions were prioritized using the cumulative score assigned to each. Each mitigation action was then 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

Table 6.4-2 presents the cumulative results of the prioritization of mitigation actions. 14 actions were ranked High Priority, 39 are ranked Medium Priority, with the remaining 16 ranked as Low Priority.

TABLE 6.4-2 PRIORITIZATION OF MITIGATION ACTIONS.

Mitigation Actions		Multi-Objective Mitigation Action Prioritization Criteria					Priority
Action No.	Name	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Critical Communications /Infrastructure	
1	Provide emergency generators at multiple facilities which can afford shelter during an emergency.	3	2	3	3	2	2.6
2	Build another bridge across Hazle Creek in the Borough in order to provide an emergency access route in the event the current bridge over Hazle Creek becomes damaged or unusable.	2	1	2	2	2	1.7
3	Conduct youth outreach campaign aimed at existing hazard and hazard mitigation education.	1.5	3	2	2	1	2.1
4	Hold public forum to educate public about types of hazard mitigation that can be done on an individual basis.	1.5	3	2	2	1	2.1
5	Identify critical transportation arteries and evaluate means to open roads for emergency access.	2	2	2.5	2	2	2.1

Mitigation Actions		Multi-Objective Mitigation Action Prioritization Criteria					Priority
Action No.	Name	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Critical Communications /Infrastructure	
6	After a flood event or windstorm provide information on alternatives to reconstruction of structures that sustain damages more than or equal to 50% of value to property owners.	1.5	2	1	2.5	1	1.6
7	Work with County Tax Assessor and GIS Department to complete detailed mapping initiative to incorporate parcel and zoning information into countywide dataset.	2.5	3	2	2.5	1	2.3
8	Install flood gates at Tippets Dam.	2.5	1.5	1	3	1.5	1.8
9	Foster increased cooperation and communication between Carbon County and the four significant out-of-county high-hazard dams that could impact Carbon through education, outreach, and dam failure scenarios or exercises, as appropriate.	1.5	2	1	1	1.5	1.5
10	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.	1	2	1	3	1	1.6
11	Conduct low level benefit-cost analysis to determine most appropriate project solution to flooding of homes on those streets previously identified as having high vulnerability to flooding.	2	1.5	1	3	1	1.7
12	Replace pipes and re-grade Rhume Run from the mouth at Nesquehoning Creek to the headwaters.	3	2	1	3	2	2.2
13	Extend pipe at Franklin and Fireline Road culvert to the stream in order to prevent flooding.	3	2	1	3	1	2.0
14	Increase the culvert/pipe sizes at identified problem sites.	3	2	1	3	1	2.0
15	Continue to provide property owners information on how to obtain flood insurance from the NFIP.	1	2	1	3	1	1.6
16	Raise SR 895 at known vulnerable sections.	3	2	1	3	1	2.0
17	Evaluate the inclusion of more restrictive floodplain management requirements in floodplain management ordinance in those communities showing increased population and development trends.	3	2.5	1	3	1.5	2.2
18	Install storm drains on Germans Road at identified location to prevent flooding.	3	1.5	1	3	1	1.9
19	Install/replace/repair culverts previously identified as problem areas Borough-wide.	3	1.5	1	3	1	1.9
20	Undertake stormwater management in the Borough.	3	2.5	2	3	2	2.5

Mitigation Actions		Multi-Objective Mitigation Action Prioritization Criteria					Priority
Action No.	Name	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Critical Communications /Infrastructure	
21	Dredge Panther Creek near Edgemont Road and Oak Streets and along Dock Street area.	1	1.5	1	3	1	1.5
22	Install new storm water collection drains to stormwater system at previously identified locations.	3	2.5	2	3	2	2.5
23	Re-grade and repair 23 additional stormwater inlet culverts.	3	2	1	3	1	2.0
24	Perform flood control along South and North Stagecoach Roads.	3	2	1	3	1	2.0
25	Clean streets and protect piers and abutments of various bridges and culverts within the Borough to prevent flooding and/or structure failure.	3	2	1	3	1	2.0
26	Construct adequate culvert in Gypsy Hill Road.	3	2.5	2	3	2	2.5
27	Clean and repair catch basins and stormwater controls throughout community to eliminate local flooding.	3	2.5	2	3	2	2.5
28	Redirect water from Hunter's Creek to the Buckwha Creek in order to alleviate flooding problems.	3	2	2	3	2	2.4
29	Dredge the 1,000 feet of the Aquashicola Creek that currently remain undredged from the 1998 Army Corps dredging project.	1	1.5	1	3	1.5	1.5
30	Widen obsolete narrow bridges on township and state roads which cross various small streams and restrict water passage during high water conditions.	2	1	1	3	2	1.7
31	Remove gravel bars, vegetation and silt deposits from Nesquehoning Creek from the Jim Thorpe-Nesquehoning Borough Line to Tippets Dam.	1.5	1.5	1	3	2	1.7
32	Replace pipes and construct a stormwater collection system along SR 54 to prevent flooding.	3	2	2	3	2	2.4
33	Repair storm drains that collapse due to flooding or washing out of roads during storms.	3	2.5	2	3	2	2.5
34	Increase the height of the banks of Hazle Creek that runs through the Borough's downtown.	2	1	1	3	1.5	1.6
35	Divert stormwater from SR 4006 at identified problem area to storm sewer system to Hazle Creek.	2	2	1	3	1.5	1.9
36	Install a storm sewer system to control stormwater from High Street, Jefferson Street, Franklin Street, and Dunningan Street.	3	2.5	2	3	2	2.5
37	Elevate Blue Mountain Road (road to fire department).	3	2	3	3	2	2.6
38	Map location of pipes, culverts and channels and perform routine maintenance.	2	3	2	3	1	2.3

Mitigation Actions		Multi-Objective Mitigation Action Prioritization Criteria					Priority
Action No.	Name	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Critical Communications /Infrastructure	
39	Mitigate flood damage to 3 critical facilities located within the 1% annual-chance floodplain.	3	2.5	1.5	3	3	2.6
40	Install retaining walls or overflow systems to divert stormwater flowing from the old water reserve dam located on the mountain north of the Borough, under the railroad tracks to the Hazle Creek. This will prevent flooding of the electric substation.	2.5	2.5	1	3	3	2.4
41	Correct water run-off problems on various Township roads to prevent washouts during heavy rains.	2	2	1	3	2	2.0
42	Re-build road shoulder and install retaining walls at stream crossings where shoulders and guardrails have been routinely washed out.	2	2	3	3	2	2.4
43	Correct water run-off problems within other areas of the Borough to prevent washouts of roads during storms.	2	2	1	3	2	2.0
44	Re-grading and repair of hillside, adjacent to pool pump house at rear of Lansford Pool.	2.5	2.5	2	2	1	2.1
45	Install traffic lights and other necessary traffic control devices at high accident intersections.	3	2.5	1	1	1	1.9
46	Trim trees along roads electrical distribution system to prevent power outages during storms.	3	3	2	1	2	2.4
47	Clear large trees adjacent to PPL power lines on Summer Mountain Road.	3	3	2	1	2	2.4
48	Improve access to electric transmission line along the Lehigh River.	2	2	3	1	3	2.2
49	Purchase of an emergency generator to operate raw water pump station.	3	2.5	2	1	3	2.4
50	Install remaining dry hydrants at water's edge encompassing Lake Harmony.	3	3	1	3	2.5	2.5
51	Target subdivisions and housing developments for Firewise program participation.	3	3	1	3	2.5	2.5
52	Designate fire lane in identified critical areas.	2	3	1	3	2	2.3
53	Utilize Fire House as storm shelter during winter storms.	2.5	3	2	3	1	2.4
54	Repair and widen Packerton Dam Drive to correct a hazardous narrow road that accumulates water and ice.	3	2.5	3	3	1	2.6
55	Resurface portions of various streets and intersections.	2	1.5	3	2	1	1.9
56	Remove large trees over power lines on Golf Road, south to the Palmerton Borough line.	2	2	2	2	2	2.0

Mitigation Actions		Multi-Objective Mitigation Action Prioritization Criteria					Priority
Action No.	Name	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Critical Communications /Infrastructure	
57	Township Engineer will work with local communities to develop stormwater management plan.	3	3	1	3	1	2.3
58	Provide 2nd access to be used during emergency at Little Gap Estates.	2.5	2	3	3	1.5	2.4
59	Replace/improve storm catches and lines in low lying and traffic areas.	2.5	2	1	3	1	1.9
60	Control flow of water along roadways.	2.5	2.5	1	3	1	2.1
61	Invite stakeholders to form a River Task Force to address increased number of rescues that have occurred within County waterways.	2	2	1	2	1	1.7
62	Vaccination remains a powerful tool for preventing or mitigating influenza outbreaks. Continue to offer flu and other infectious disease vaccination clinics to residents, ensuring access by vulnerable populations.	2	2	1	1	1	1.5
63	Increase frequency of National Incident Management System (NIMS), Incident Command System (ICS), and Crowd Control trainings for County and local law enforcement.	1.5	2	1	1	1.5	1.5
64	Work with Northeast Regional Terrorism Taskforce to purchase additional equipment for civil disturbance incidents.	1.5	2	1	1	1.5	1.5
65	Obtain grant funding for the acquisition, demolition, demolition/reconstruction, relocation, and/or elevation of structures that are vulnerable to flooding.	3	3	1.5	3	3	2.7
66	Evaluate the risk and hazard of wildland fire to the communities of Carbon County by developing a Hazard Fuel Reduction Program for the most "at-risk' communities; educating and training first responders to better handle large scale incidents, evaluating the social and economic impact of a catastrophic wildfire to communities, and form a stakeholder group to develop a county-wide wildland fire mitigation plan.	2	2	1	3	1.5	1.9
67	Ensure critical facilities list for the County and all municipalities remains current and accurate.	3	3	3	2	3	2.9
68	Identify dam-related deficiencies and determine the best approach to address them.	2	1	2	2	2	1.7
69	Provide notice of funding opportunity and supporting documentation from the County HMP to EMCs and the municipality with High Hazard Potential Dams to promote rehabilitation and safety in Centre County.	1	3	1	1	3	1.9

7. Plan Maintenance

7.2. *Update Process Summary*

Once this Plan has received approval from PEMA and ultimately FEMA, the Plan will be adopted by the Carbon County and all participating jurisdictions. This HMP Update is intended to be a 'living document'. Plan adoption is not considered the final step in the planning process but rather as a first step to 'realization'. The plan monitoring and maintenance schedule is a cycle of events that involve periodic review, adjustments, and improvement. Plan monitoring also provides an opportunity to recognize other planning initiatives within the county that may benefit from the incorporation of risk and/or mitigation objectives detailed in the HMP. This section establishes a method to monitor how the Plan will be evaluated and maintained in the future.

7.3. *Monitoring, Evaluating, and Updating the Plan*

In order to ensure that the Plan continues to provide a framework of reducing risk in Carbon County, the Department of Planning & Development and the Emergency Management Agency will lead the HMPT in all associated plan maintenance requirements, including annual reviews. The HMPT is comprised of County and municipal officials involved in the preparation of the Plan Update as well as other relevant stakeholder representatives that participated in the planning process.

An Annual Review Checklist has been developed for routine HMP maintenance and will be used as a guide for the annual plan maintenance and update. The Hazard Risk table will be reviewed and any changes to rankings based on frequency or severity to profiled hazards will be documented. Municipal officials will be asked to provide a mitigation action progress information each year and the Mitigation Action Plan will be updated accordingly. The HMPT will prepare an annual update report of the mitigation actions based on the annual report forms from the municipalities as well as the County. The annual HMP review will be scheduled each year during the week of the HMP approval anniversary. The following questions will be considered as criteria for assessing the effectiveness of the HMP:

- Has the nature or magnitude of hazards affecting the county changed?
- Are there new hazards that have the potential to impact the county?
- Is there updated, or more quantitative, risk assessment data available related to the identified hazards in the plan? Can this data be integrated into the analysis to better assess the vulnerability, and depict the risk, of communities to the hazards?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?
- Are there current or upcoming planning mechanisms or initiatives in which the mitigation strategy should be considered for integration?

In addition to conducting an annual review of the Plan, the HMPT will review the Plan within 30 days of a disaster. The Risk Assessment and Mitigation Strategy will be evaluated and any changes to community priorities or status will be documented. The HMP will receive a full,

detailed update every five years, as required to reflect the current risk, vulnerabilities, development trends and as mitigation actions are implemented. While an annual report will be completed each year, any state and Federal mandates from PEMA and FEMA respectively, will be addressed in the five-year update. The municipalities will not be responsible for making any changes to the HMP document as part of annual reviews; their role will consist of providing any relevant information that would be applicable during the review.

Each municipality will designate a community representative to monitor mitigation activities and hazard events within their respective communities. The local emergency management coordinator would be suitable for this role. This individual will be asked to work with the HMPT to provide updates on applicable mitigation actions and feedback on changing hazard vulnerabilities within their community.

Upon each HMP evaluation, the HMPT will consider whether applications should be submitted for existing mitigation grant programs. A decision to apply for funding will be based on appropriate eligibility and financial need requirements. The HMPT will also support local and County officials in applying for post-disaster mitigation funds when they are available. All state and federal mitigation funding provided to the County or local municipalities will be reported in subsequent plan updates. In addition, new plans and programs being developed within the County will be evaluated as to the ability and necessity to incorporate the 2021 HMP into them.

7.4. *Continued Public Involvement*

As was done during development of the 2021 HMP, the HMPT will involve the public during annual review periods by providing an opportunity to review and submit feedback. The public will have access to the current HMP through their local municipal office or on the Carbon County government website. Responses from the community hazard mitigation survey revealed that the best way for the public to received information about risk and preparedness would be through the municipal or county website, or via email/newsletter. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, social media, and the county website. The public is encouraged to submit comments on the HMP at any time. The HMPT will incorporate all relevant comments during the next update of the hazard mitigation plan.

The Comprehensive Plan, Capital Improvements Program, Building Code, Municipal Floodplain Management Regulations, Emergency Operations Plan, and Zoning Ordinance are identified for incorporation of hazard mitigation actions once the Plan is adopted. Each of these mechanisms will continue to be used to meet the intent of this Plan, as appropriate. Likewise, as these planning mechanisms are updated, they will be considered for incorporation into the HMP during the annual review process and/or the five-year cycle update.

The County and participating jurisdictions may propose additional mitigation actions for inclusion throughout the five-year cycle but must submit new mitigation actions through the Department of Planning & Development which will request an HMP amendment by contacting the PEMA State Hazard Mitigation Planner. FEMA must officially approve all additions and will amend the HMP by issuing an HMP Amendment Approval letter.

8. Plan Adoption

The Plan was submitted to the Pennsylvania State Hazard Mitigation Planner on June 21, 2021.

This section of the plan includes copies of the local adoption resolutions passed by Carbon County and its municipal governments. The completed Local Mitigation Plan Review Crosswalk can be found in Appendix B. Adoption resolution templates are provided to assist the County and municipal governments with recommended language for future adoption of the HMP.

CARBON COUNTY 2021 HAZARD MITIGATION PLAN

County Adoption Resolution

Resolution No. _____
Carbon County, Pennsylvania

WHEREAS, the municipalities of Carbon County, Pennsylvania are most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and

WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and

WHEREAS, Carbon County acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and

WHEREAS, the Carbon County 2021 Hazard Mitigation Plan has been developed by the Carbon County Department of Planning & Development in cooperation with Carbon County Emergency Management Agency, other county departments, local municipal officials, institutional stakeholders, and the citizens of Carbon County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Carbon County 2021 Hazard Mitigation Plan, and

WHEREAS, the Carbon County 2021 Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the County of Carbon that:

- The Carbon County 2021 Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the County, and
- The respective officials and agencies identified in the implementation strategy of the Carbon County 2021 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: CARBON COUNTY COUNCIL

_____ By _____

By _____

CARBON COUNTY 2021 HAZARD MITIGATION PLAN

Municipal Adoption Resolution

Resolution No. _____
< Municipality Name>, Carbon County, Pennsylvania

WHEREAS, the *<Borough/Township of Municipality Name>*, Carbon County, Pennsylvania is most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and

WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and

WHEREAS, the *<Borough/Township of Municipality Name>* acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and

WHEREAS, the Carbon County 2021 Hazard Mitigation Plan has been developed by the Carbon County Department of Planning & Development in cooperation with Carbon County Emergency Management Agency, other county departments, local municipal officials, institutional stakeholders, and the citizens of Carbon County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Carbon County 2021 Hazard Mitigation Plan, and

WHEREAS, the Carbon County 2021 Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the *< Municipality Name>*:

- The Carbon County 2021 Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the *<Borough/Township/City>*, and
- The respective officials and agencies identified in the implementation strategy of the Carbon County 2021 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2020

ATTEST: < MUNICIPALITY NAME>

_____ By _____

By _____