CENTRE COUNTY 2021

HAZARD MITIGATION PLAN UPDATE

PREPARED FOR:

Centre County
Office of Emergency Services
Planning and Community Development Office
420 Holmes Street
Bellefonte, Pennsylvania 16823

PREPARED BY:

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

CENTRE COUNTY PENNSYLVANIA

Michael Baker INTERNATIONAL

CERTIFICATION OF ANNUAL REVIEW MEETINGS

The Centre County Hazard Mitigation Steering Committee (HMSC) has reviewed this Hazard Mitigation Plan (HMP) Update. See Section 8 for further details regarding this form. The HMSC hereby certifies the review.

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED?*	SIGNATURE
2016	N/A	N/A	To the best knowledge of the Centre County HMSC, no HMP meetings were held before the beginning of the HMP Update process. See Section 3 of the Centre County 2021 HMP Update for details regarding the meetings held during this process.
2017	N/A	N/A	
2018	N/A	N/A	
2019	N/A	N/A	
2020	See Section 3	See Section 3	
2021			
2022			
2023			
2024			
2025			

**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 Centre County HMSC, no HMP progress reports were submitted from municipalities for the period from 2016 through 2020, although 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.

TABLE OF CONTENTS

TABLE OF TABLES

ACRONYMS

ACRONYM	DEFINITION
CCPC	Centre County Planning Commission
CCPCDO	Centre County Planning and Community Development Office
CFR	Code of Federal Regulations
CRS	Community Rating System
DCED	Department of Community and Economic Development
DCNR	Department of Conservation and Natural Resources
DCNR-BOF	Department of Conservation and Natural Resources-Bureau of Forestry
DMA	Disaster Mitigation Act
EMC	Emergency Management Coordinator
EMS	Emergency Medical Services
EOP	Emergency Operations Plan
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance Program
GIS	Geographic Information System
HHPD	High Hazard Potential Dam
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HMPT	Hazard Mitigation Planning Team
HMSC	Hazard Mitigation Steering Committee
IBC	International Building Code
ICC	International Code Council
NCDC	National Climatic Data Center
NCEI	National Centers for Environmental Information
NDIS	National Drought Information System
NDMC	National Drought Mitigation Center
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NHC	National Hurricane Center
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OES	Office of Emergency Services
PA DEP	Pennsylvania Department of Environmental Protection
PA DOH	Pennsylvania Department of Health

PaGWIS	Pennsylvania Groundwater Information System
PASDA	Pennsylvania Spatial Data Access
PDM	Pre-Disaster Mitigation Assistance Program
PDSI	Palmer Drought Severity Index
PEIRS	Pennsylvania Emergency Incident Reporting System
PEMA	Pennsylvania Emergency Management Agency
PennDOT	Pennsylvania Department of Transportation
RF	Risk Factor
SALDO	Subdivision and Land Development Ordinance
SFHA	Special Flood Hazard Area
SOG	Standard Operating Guide
UCC	Universal Construction Code
US DOT	United States Department of Transportation
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WYO	Write Your Own

1. INTRODUCTION

1.1 BACKGROUND

Across the United States, natural and human-made disasters have led to increasing levels of deaths, injuries, property damage, and interruption of business and government services. The time, money, and effort needed to recover from these disasters exhausts resources, diverting attention from important public programs and private agendas. Since 1955 there have been 62 Presidential Disaster Declarations and Emergency Declarations in Pennsylvania, 15 of which have affected Centre County, Pennsylvania. The emergency management community, citizens, elected officials and other stakeholders in Centre County recognize the impact of disasters on their community and support proactive efforts needed to reduce the impact of natural and human-made hazards.

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

Accordingly, the Centre County Hazard Mitigation Steering Committee (HMSC), composed of government leaders in the Centre County Office of Emergency Services (OES) and Planning and Community Development Office, in cooperation with the elected officials of the County and its municipalities, have prepared this Hazard Mitigation Plan (HMP) Update. The 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.

The Centre County Office of Emergency Services and Planning and Community Development Office have taken an all-hazards approach to this Hazard Mitigation Plan Update.

1.2 PURPOSE

This HMP Update was developed for the purpose of:

- Providing a blueprint for reducing property damage and saving lives from the effects of future natural and human-caused disasters in Centre 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;
- Demonstrating a firm local commitment to hazard mitigation principles; and
- Improving community resiliency following a disaster event.

Adoption of this plan ensures that Centre 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 Federal Emergency Management Agency (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

The Centre County 2021 HMP Update has been prepared to meet requirements set forth by FEMA and the Pennsylvania Emergency Management Agency (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 address both natural and human-made hazards determined to be probable and/or present a risk for multiple deaths/injuries and property damages to the local municipalities within the County. Updates will take place following significant disasters or at a minimum this plan will be subject to review and update on an annual basis.

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

1.4 AUTHORITY AND REFERENCE

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 2013.

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

2.1 GEOGRAPHY AND ENVIRONMENT

Centre County covers approximately 1,115 square miles and is located in the geographic center of the Commonwealth of Pennsylvania. The County is divided diagonally almost equally into two parts, bisected by the Allegheny Front, a feature of the Appalachian Mountain Range which runs from northeast to southwest across eastern and south-central Pennsylvania. The northwestern half of Centre County is comprised of the rugged foothills of the Allegheny Plateau with the southeastern half comprised of prominent ridges and valleys. At its widest point, from Rush Township in the southwest to the very tip of Miles Township in the east, it stretches approximately 67 miles across. The County Seat is the Borough of Bellefonte, centrally located within the Nittany Valley. Figure 2.1-4 illustrates the County's transportation network, water bodies, and municipal boundaries.

The most significant watercourse is Bald Eagle Creek, which runs diagonally from southwest to northeast through the middle of the County and is a tributary of the West Branch of the Susquehanna River. Other watercourses include Moshannon Creek, also a tributary of the West Branch of the Susquehanna River and western boundary of the County, Penn's Creek which flows eastward into the main branch of the Susquehanna River just south of Sunbury, and Spring Creek which flows north to its confluence with Bald Eagle Creek in Milesburg Township. Water bodies make up approximately 0.36 percent of the County's geographic area. Figure 2.1-5 shows the watersheds that comprise the County.

Adjacent counties include Clinton County to the north, Union and Mifflin Counties along the east and southeastern border, Huntingdon and Blair Counties to the south, and Clearfield County to the west.

Figure 2.1-1: Centre County Courthouse (CCPCDO, 2017)

Figure 2.1-2: Philipsburg Borough, Centre County (CCPCDO, 2017)

Figure 2.1-3: Philipsburg Borough, Centre County (CCPCDO, 2017)

Figure 2.1-4: Centre County Base Map

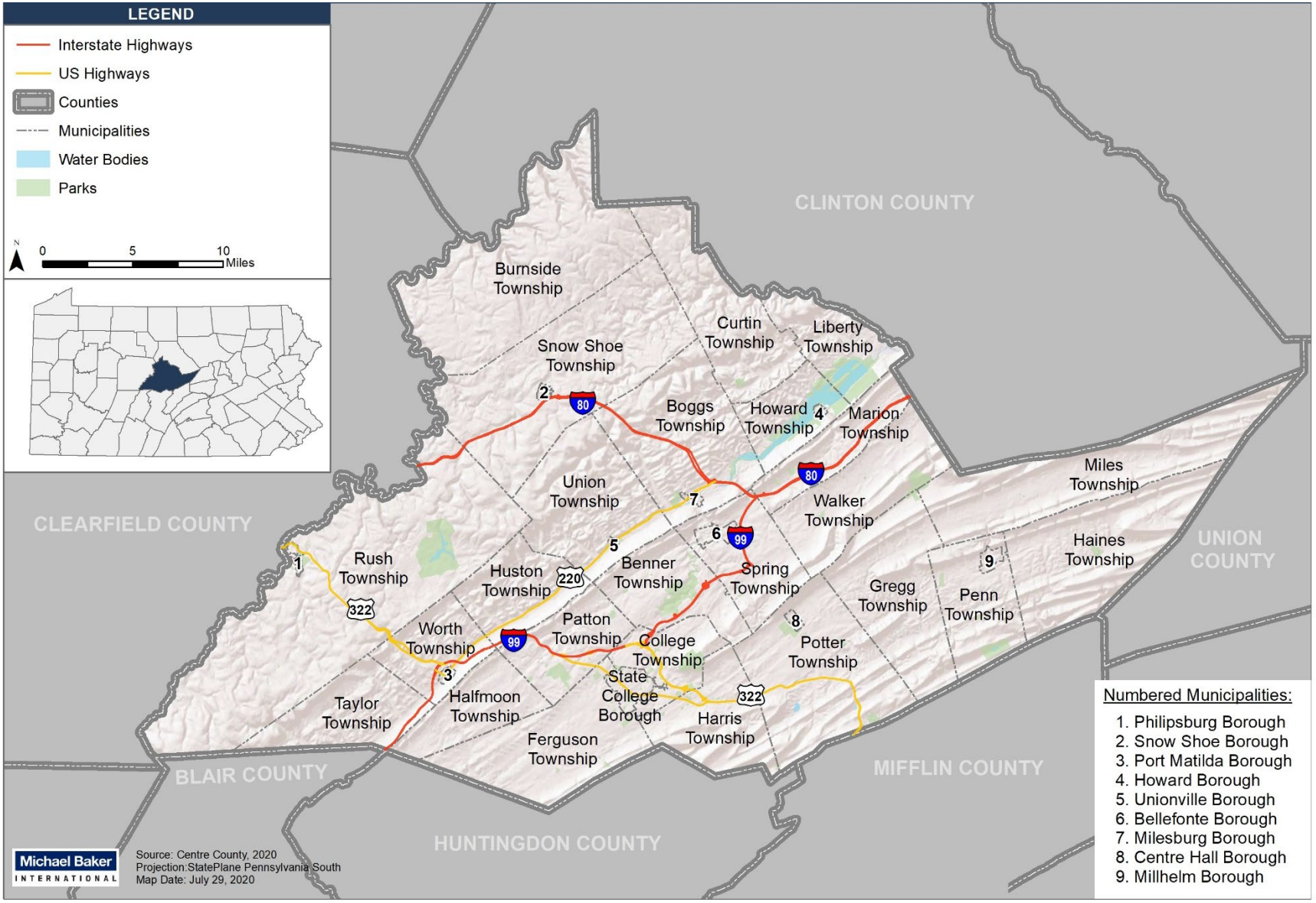
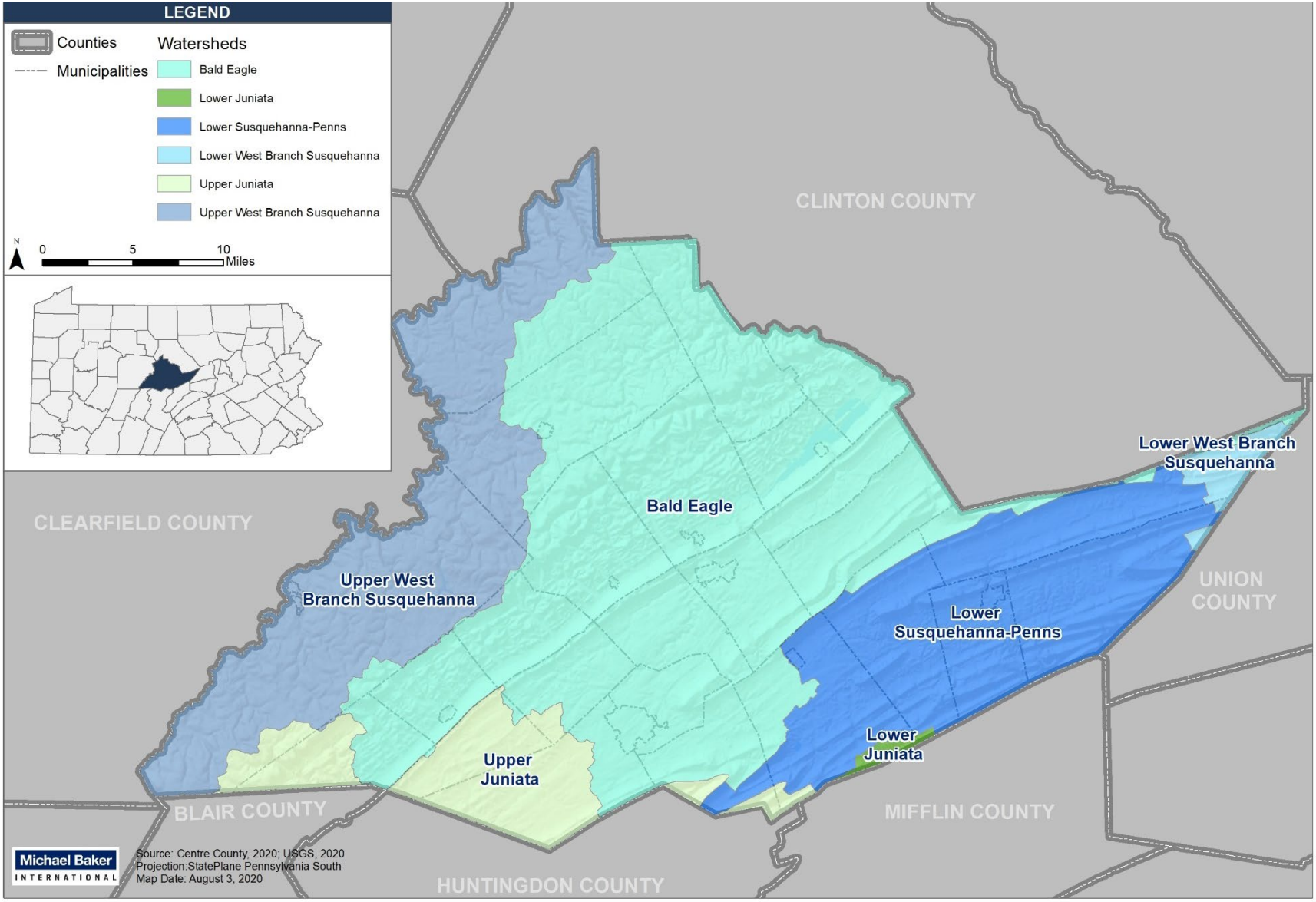


Figure 2.1-5: Centre County Watersheds



2.2 COMMUNITY FACTS

Centre County was formed on February 13, 1800, from parts of Huntingdon, Lycoming, Mifflin, and Northumberland Counties. Throughout history, settlement has concentrated in the eastern half of the County, which possessed abundant natural resources to support a burgeoning iron industry. In fact, Centre County takes its name from the first iron furnace established – Centre Furnace, built in 1791. In 1855, the Farmer's High School of Pennsylvania was established, which would eventually become the Pennsylvania State University (Penn State). Centre Furnace ceased producing iron in 1858, and by the 20th century education became the County's major emphasis.

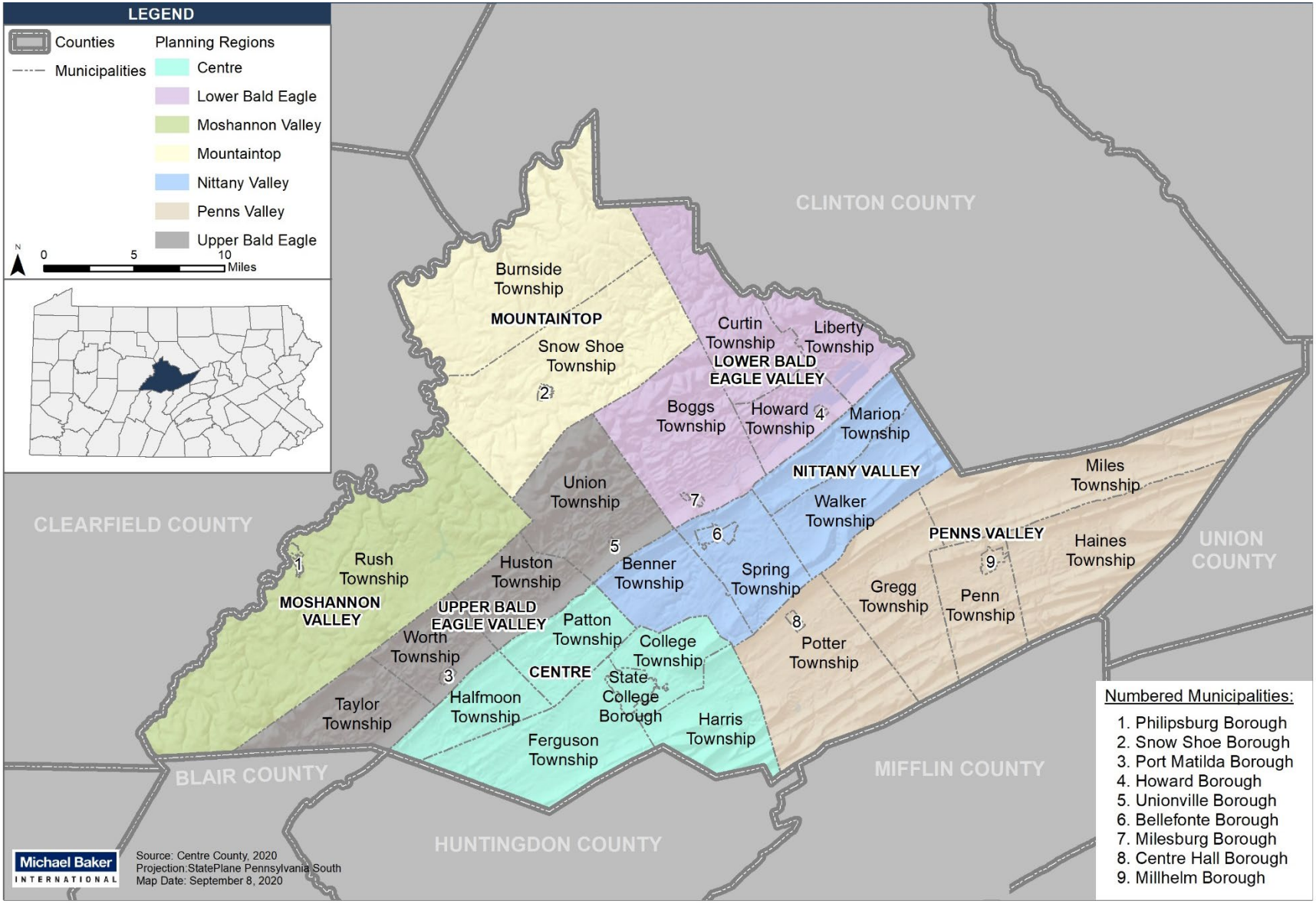
As seen in Table 2.2-1, from 1960 to 2018, Centre County's population more than doubled. The majority of this growth has been concentrated in the Centre Region, a planning area that encompasses State College Borough and five adjoining townships. This explosive growth can be attributed to the economic impact of Penn State, which has fueled growth in high-tech industries and attracted a highly educated workforce. The balance of the County's population growth has been concentrated in the suburban townships along State Route 26 and U.S. Route 322. Centre County remains a predominantly rural community with 75 percent of the County's land area forested, while another 15 percent is classified as agricultural land use (CCPCDO, 2015). Although the acreage being actively farmed has decreased throughout the years, farming remains an important land use in Centre County. The County has 35 governmental municipalities – 25 townships and 10 boroughs, which are listed in Table 2.3-1.

Table 2.2-1: Centre County Population Growth, 1960-2018 (U.S. Census, American Community Survey (ACS))

YEAR	TOTAL POPULATION	PERCENT CHANGE (%)
1960	78,580	-
1970	99,267	26%
1980	112,760	14%
1990	123,786	10%
2000	135,758	10%
2010	153,990	13%
2018 Estimate	161,443	5%
Total		105%

The Centre County Planning Commission (CCPC) is comprised of elected officials to represent seven distinct regions of the County (as depicted in Figure 2.2-2 and identified by municipality in Table 2.3-1). Additionally, the Centre County Metropolitan Planning Organization (CCMPO) has responsibility for coordinating transportation planning efforts throughout all of Centre County, including the Centre County Long Range Transportation Plan 2050 (adopted September 2020) and the 2021-2024 Transportation Improvement Program that took effect on October 1, 2020.

Figure 2.2-1: Centre County Planning Regions



The University Park Campus of Penn State University is the only major college located within the County in the Borough of State College. The total enrollment at the University Park Campus in Fall 2019 was 46,723 students. The campus has 6,495 full-time and 6,410 part-time employees (12,905 total employment) (Penn State, 2020a). Additionally, within Centre County there is a vocational and technical training institute and a total of seven public school districts (CCPCDO, 2019a).

Centre County is included in the State College Metropolitan Statistical Area (MSA). There are two major (interstate) highways that traverse the County. I-80 is a major east-west route across the United States, connecting northern New Jersey with California and is a principal route for truck and freight traffic. I-99 connects I-80 in the Nittany Valley of Centre County with the Pennsylvania (PA) Turnpike (I-76) in the vicinity of Bedford, PA. I-99 travels roughly in a north-south direction. In July 2018, funding for the first phase of a project to build a high-speed interchange connection between I-99 and I-80 was awarded through an INFRA (Infrastructure for Rebuilding America) grant. The project "will allow for safer travel between I-99, I-80, Route 26, and other local roads" (PennDOT, 2020b). Two major US highways include US Route 322, and US 220. Other major state roads include PA Route 26, PA Route 150, PA 144, PA 350, PA 45, and PA 64. This network of roads serves both the major regional traffic movements (freight and major event traffic) and local trips within Centre County. Additionally, the University Park Airport, located in Benner Township and owned by Penn State, provides commercial flights to/from the County. Transportation and land uses are shown on Figure 2.4-1.

It should also be noted that fixed route public transportation is provided by the Centre Area Transportation Authority (CATA). In 2019, this system provided approximately 6.4 million trips within a 135 square mile service area focused on the State College and Bellefonte area. There is a reported maximum of 125 vehicles available for this service on 21 community routes. Other services provided by CATA include commuter assistance (vanpool and rideshare services) and demand-response (curb-to-curb) transportation for special needs populations (PennDOT, 2019a). Additionally, the Centre County Office of Transportation offers a countywide, demand responsive shared-ride service that brings riders door-to-door (CCOT, 2021).

2.3 POPULATION AND DEMOGRAPHICS

The population of Centre County in 2010 was 153,990 (U.S. Census, 2010). The U.S. Census estimates that in 2018, Centre County's population reached 161,443 people. These estimates demonstrate that the County's population is growing faster than surrounding areas, some of which are shrinking, but at a modest rate. Centre County has a young population, with the median age of the County in 2018 estimated at 31.7 years of age. The County also has a high percentage of college-age persons due to the presence of Penn State University (U.S. Census Bureau, 2018). Approximately 24 percent of the County's population is between the ages of 18 and 24.

Population density is highest in and around the State College Borough. Further population growth over the next 30 years is expected to be greatest in the Centre Region, Nittany Valley,

and Penns Valley Planning Regions due to their adjacent location to the University. Table 2.3-1 provides a distribution of County population by municipality obtained from the U.S. Census Bureau and American Community Survey (ACS) 2014-2018 five-year estimates. The 2018 populations are estimated projections based on the 2010 Census. Additionally, the entirety of the student population may not be accounted for in Census populations; college students often identify their permanent address as the residence of their parent or guardian.

Table 2.3-1: Centre County Population by Municipality, 2010-2018 (U.S. Census Bureau, 2018)

MUNICIPALITY	PLANNING REGION	2010 POP.	2018 POP.	% CHANGE
Bellefonte Borough	Nittany Valley	6,187	6,289	2%
Benner Township	Nittany Valley	6,188	9,242	33%
Boggs Township	Lower Bald Eagle Valley	2,985	2,925	-2%
Burnside Township	Mountaintop	439	436	-1%
Centre Hall Borough	Penns Valley	1,265	1,244	-2%
College Township	Centre	9,521	10,147	6%
Curtin Township	Lower Bald Eagle Valley	618	614	-1%
Ferguson Township	Centre	17,690	19,118	7%
Gregg Township	Penns Valley	2,405	2,469	3%
Haines Township	Penns Valley	1,564	1,600	2%
Halfmoon Township	Centre	2,667	2,755	3%
Harris Township	Centre	4,873	5,612	13%
Howard Borough	Lower Bald Eagle Valley	720	670	-7%
Howard Township	Lower Bald Eagle Valley	964	1,007	4%
Huston Township	Upper Bald Eagle Valley	1,360	1,294	-5%
Liberty Township	Lower Bald Eagle Valley	2,118	2,049	-3%
Marion Township	Nittany Valley	1,224	1,470	17%
Miles Township	Penns Valley	1,983	2,223	11%
Milesburg Borough	Penns Valley	1,123	964	-16%
Millheim Borough	Penns Valley	904	606	-49%
Patton Township	Centre	15,311	15,905	4%
Penn Township	Penns Valley	1,181	1,334	11%
Philipsburg Borough	Moshannon Valley	2,770	2,731	-1%
Port Matilda Borough	Upper Bald Eagle Valley	606	596	-2%
Potter Township	Penns Valley	3,517	3,577	2%
Rush Township	Moshannon Valley	4,008	4,009	0%
Snow Shoe Borough	Mountaintop	765	876	13%
Snow Shoe Township	Mountaintop	1,746	1,697	-3%
Spring Township	Nittany Valley	7,470	7,741	4%
State College Borough	Centre	42,034	42,256	1%
Taylor Township	Upper Bald Eagle Valley	853	791	-8%
Union Township	Upper Bald Eagle Valley	1,383	1,435	4%
Unionville Borough	Upper Bald Eagle Valley	291	238	-22%

Table 2.3-1: Centre County Population by Municipality, 2010-2018 (U.S. Census Bureau, 2018)

MUNICIPALITY	PLANNING REGION	2010 POP.	2018 POP.	% CHANGE
Walker Township	Nittany Valley	4,433	4,672	5%
Worth Township	Upper Bald Eagle Valley	824	851	3%
Total		153,990	161,443	5%

While there was a net increase in the population according to the U.S. Census estimates, Millheim Borough, Unionville Borough, and Milesburg Borough are all estimated to have lost over 15 percent of their population. While these were significant percent losses, all three municipalities have population of less than 1,000 people. Alternatively, Benner Township and Marion Township both experienced gains of more than 15 percent. Benner Township gained an estimated 3,000 people. A State Correctional Institution (SCI) was opened in Benner Township in 2013 and houses a population of roughly 2,000 (PA DOC, 2020b), accounting for two-thirds of the population increase.

It is important to note that the County's non-residential population increases significantly during Penn State Home Football Games. This occurs in and around the vicinity of State College Borough on seven weekends during the fall college football season. While the residential population of State College Borough and adjacent College Township is around 52,000, during Penn State home games as many as 110,000 people crowd into Beaver Stadium. Another significant event in the County is the Central Pennsylvania Festival of the Arts, usually referred to as "Arts Fest", held in downtown State College Borough every July. The five-day festival draws upwards of 125,000 visitors. The People's Choice Festival has historically occurred in Boalsburg at the same time as Arts Fest. This event also contributes to the large influx of visitors during that week. Population values used for the State College Borough, College Township, and other surrounding municipalities in the hazard assessments included in this HMP do not directly account for the large volume of people attending these events. However, the potential heightened impact of a hazard event occurring during either a Penn State home football game or Arts Fest on an above normal population is recognized by the County and affected municipalities.

Figure 2.3-1: Central PA Festival of the Arts, State College (CCPCDO, 2017)

In 2018, the median income of households in Centre County was estimated to be $58,055, slightly less than that of the Commonwealth of Pennsylvania as a whole at $59,455 (U.S. Census Bureau, 2018). The median age of the County population is 31.7 years with 84.8 percent of the population 18 years of age or older and 13.3 percent 65 years or older. There are approximately 66,312 total housing units in the County, with 66.1 percent classified as single-unit structures, 28.7 percent as multi-unit structures, and 5.0 percent as mobile homes. The median monthly housing costs for mortgaged homeowners is $1,554 and $539 non-mortgaged owners. The median rent is $966 per month. In Centre County 87.7 percent of the population is White, 3.7 percent is Black or African American, and 6.0 percent is Asian; 3.0 percent identifies as Hispanic or Latino (U.S. Census Bureau, 2018).

Demographic characteristics in Centre County are influenced by the student and faculty population of Penn State University. This is especially true for age, nationality, and income demographics.

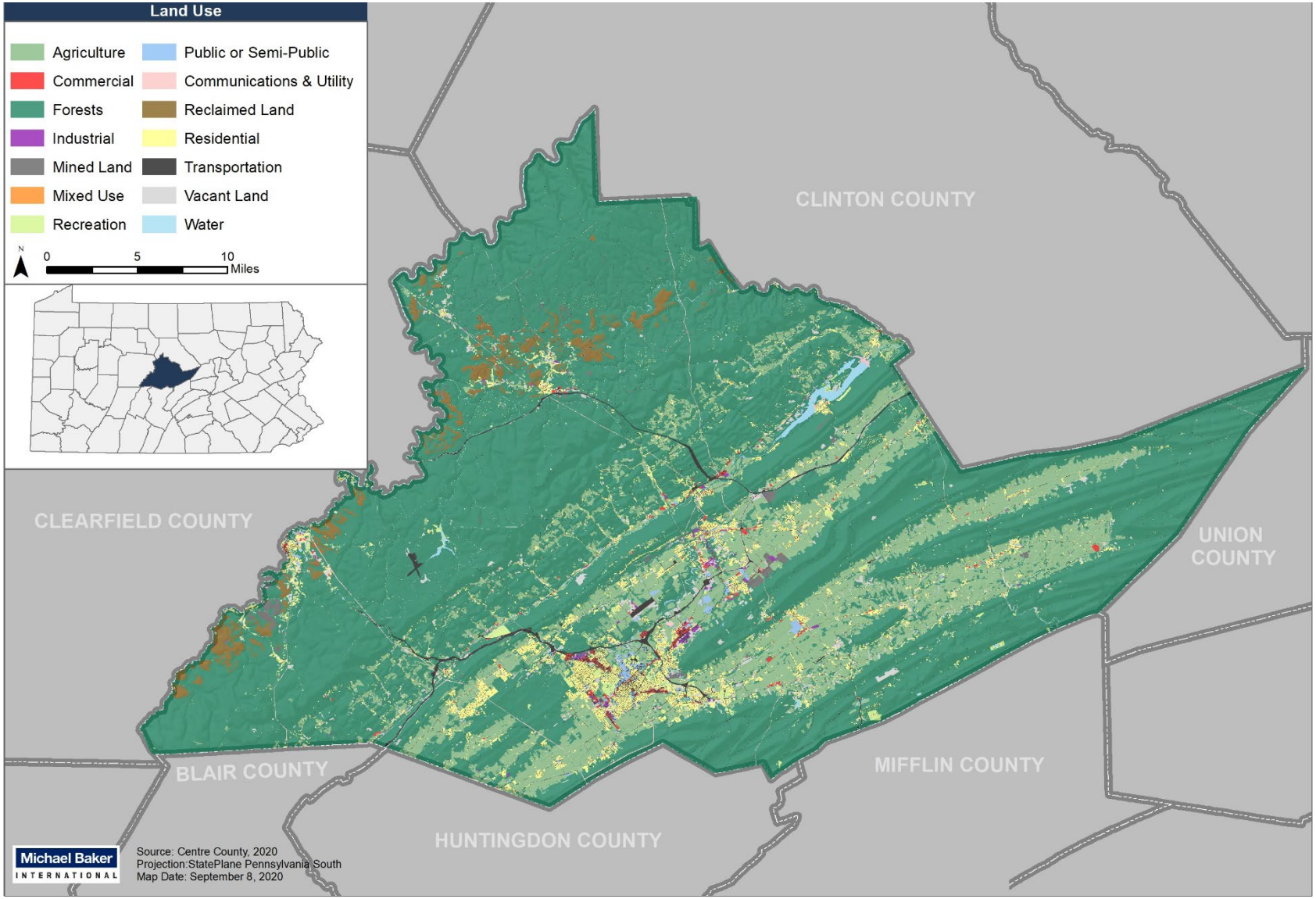
2.4 LAND USE AND DEVELOPMENT

Centre County is predominantly rural in nature, with urban and suburban population densities typically confined to the ten established boroughs within the County. Villages within Townships also exhibit urban and suburban densities including Pleasant Gap in Spring Township, Lemont in College Township, Pine Grove Mills in Ferguson Township, and Boalsburg in Harris Township. The largest concentration of development is located in the Centre Region, Penns Valley, and Nittany Valley Planning Regions. Many of the rural areas remaining in the valleys of eastern Centre County are used for agricultural purposes. Ridges and mountainous areas throughout the County limit development potential in these areas, particularly in the western half of Centre County, which remains relatively undeveloped and is dominated by second growth woodlands, state parks, and conservation areas.

County and local land use planning address urban and suburban development as well as farmland protection. The County's Agricultural Security and Agricultural Easement programs are intended to preserve the area's prime natural resources and help maintain a diverse County economy. At present, there are 89,491 acres within the County designated in Agricultural Security Areas (Centre County, 2020a). Since 1991, 55 farms totaling 8,205 acres have been preserved through easement purchase (CCPCDO, 2020). The County's agricultural preservation activities are coordinated with land use and capital improvement plans.

The highest density of development and concentration of land uses is found in State College Borough and associated with the continued development and expansion of Penn State University. The University Park campus totals approximately 8,556 acres (Penn State, 2020b). The Master Plan for this campus identifies limited opportunities for horizontal expansion of the core campus and emphasizes that future facility expansion would include options for infill and vertical growth, increasing the overall development density. In boundary analysis conducted by the University, horizontal expansion was only deemed possible in an easterly and, to a lesser extent, westerly direction. It was recognized that both the northern and southern edges of the core campus are defined by fixed residential and commercial uses. Additional discussion of future land development is provided in Section 4.4.4 – Future Development and Vulnerability.

Figure 2.4-1: 2020 Centre County Land Use



2.5 DATA SOURCES

The Centre County Geographic Information System (GIS) Office provided many datasets through their open data website: https://gisdata-centrecountygov.opendata.arcgis.com/. These datasets include land use used for analyses throughout the HMP, as well as building points and footprints in the County. The County GIS Office also provided the inventory of parcels and their assessed value, which is not available through their open data site.

The building information did not include attributes beyond the locations of the structures, such as the value of the structure, number of stories, or elevation. In order to effectively evaluate the type of structures vulnerable to individual hazards, the consultant team used a spatial join to assign a land use to each structure using the land use database. Since a spatial join was used to derive land use, if a parcel had more than one structure on it, both were given the same underlying land use. As a result, the counts of structure types used throughout this HMP should be considered estimates. The actual structure and land use may differ than information contained in the database and derived through the land use analysis.

The Centre County GIS Office provided the tax assessment database for use in estimating potential losses. The assessed values were provided for each parcel in Centre County. Structures were assigned to each parcel to determine their assessed value in addition to their land use; if there are multiple structures on a parcel, then the value increased by the number of structures. These estimated values are used solely in the Potential Loss section with this disclaimer.

For some hazards – flood, environmental hazards, and transportation hazards – the population within the hazardous area was estimated. This was determined by assigning a point to the 2010 U.S. Census population census blocks, and then spatially joining these to the municipalities in Centre County in order to derive these estimations.

Flood hazard data used in this HMP is Centre County's effective FRIM database from 2015, which is the most recent data available. The countywide FIRM, published on January 16, 2015 and was downloaded from the FEMA Map Service Center. This data provides flood frequency and elevation information used in the flood hazard risk assessment.

Additional spatial data was provided by the Pennsylvania Department of Conservation and Natural Resources (DCNR) and the Pennsylvania Department of Transportation (PennDOT). Population and demographic data from the 2010 Decennial Census and 2014-2018 ACS 5-Year Estimates were obtained from the U.S. Census Bureau.

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 were gathered. For a number of historic natural-hazard events, the data from the National Centers for Environmental Information (NCEI) (formerly National Climatic Data Center) were utilized. NCEI is part of the U.S. 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. Data used for this plan came from the 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, 2020a). The database currently contains hazard event data from January 1950 to August 2020. Other federal datasets came from the United States Geological Service (USGS), the National Hurricane Center, and NOAA's Storm Prediction Center. High Hazard Potential Dam (HHPD) data was collected from Pennsylvania Department of Environmental Protection (PA DEP) and the United States Army Corps of Engineers' (USACE) National Dam Inventory (NDI) and incorporated into the Dam Failure profile (Appendix H). PA DEP provides information from Emergency Action Plans including risk and population vulnerability.

To help document past occurrences of natural and human-made hazards, the Centre County Office of Emergency Services (OES) incident log was reviewed. This log included 755 hazard events from 1989 to April 2020. While this is not a comprehensive database of hazard events that have occurred in Centre County, it provides an inventory of events with which OES has been involved. This data was occasionally used to supplement occurrences of natural hazards but was primarily used to identify human-made hazards that generally are not cataloged in a single place, such as civil disturbances, power outages, and terrorist threats. In some instances, data was not entered in a standardized format. The data is reported the way is appears in the incident log.

Centre County 9-1-1 provided fire reports and vehicle crashes for 2016-2020, which detailed the number of calls the 9-1-1 center received regarding these incidents during these five years. The calls in these logs were categorized by type. One limitation of this data, however, is that the log is a record of the number of calls, not incidents. It is possible that a single fire event was reported by multiple callers.

Throughout the risk and vulnerability assessments included in Section 4 – Risk Assessment, descriptions of 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.

This 2021 HMP Update evaluates the vulnerability of the County's critical facilities. For the purposes of this plan, critical facilities are those entities that are essential to the health and welfare of the community. This includes airports, police stations, fire stations, EMS stations, hospitals and medical centers, jails, dams, nursing homes and long-term care facilities, day care centers, Toxics Release Inventory (TRI) sites, schools (public and private), water treatment facilities, sewer treatment facilities, and oil and gas wells. The locations of and information about these facilities was provided by the Centre County GIS Office. Due to the volume of oil and gas wells in the County, the vulnerability of these facilities is analyzed independent of the other critical facilities.

Table 2.5-1 summarizes the critical facilities in Centre County by type and data source, and Table 2.5-2 summarizes critical facilities by municipality and type. For a complete listing of critical facilities and their vulnerability to individual hazards, please see Appendix E.

Table 2.5-1: Critical Facilities in Centre County by Type and Data Source

TYPE	NUMBER IN COUNTY	DATA SOURCE
Airport	11	County
Conventional Well	1,421	PA DEP
Dams	48	County
Day Care Center	53	NHILD
EMS	15	County
Fire Stations	22	County
Hospitals and Medical Centers	33	County
Jails	4	County
Nursing Homes	6	PA DOH
Personal Care Facilities	11	County
Police Stations	9	County
Schools	71	County
Sewer Treatment Plants	24	County
TRI Facility	26	EPA TRI
Unconventional Well	195	PA DEP
Water Treatment Plant	46	County

Centre County considers 15 types of facilities critical essential to the health and welfare of the community:

- Airports
- Police Stations
- Fire Stations
- EMS Stations
- Hospitals and Medical Centers
- Jails
- Dams
- Nursing Homes and Long-term Care Facilities
- Personal Care Facilities
- Day Care Centers
- TRI Sites
- Schools (public & private)
- Water Treatment Facilities
- Sewer Treatment Facilities
- *Conventional and Unconventional Oil and Gas Wells*

Table 2.5-2: Critical Facilities by Municipality and Type

MUNICIPALITY	AIRPORT	CONVENTIONAL WELL	DAMS	DAY CARE CENTER	EMS	FIRE STATIONS	HOSPITALS AND MEDICAL CENTERS	JAILS	NURSING HOMES	PERSONAL CARE	POLICE STATIONS	SCHOOLS	SEWER TREATMENT PLANTS	TRI FACILITY	UNCONVENTIONAL WELL	WATER TREATMENT PLANT	TOTAL
Bellefonte Borough	0	0	1	2	2	2	1	0	1	0	2	4	0	1	0	1	17
Benner Township	2	0	4	3	1	1	1	4	0	0	1	1	0	4	0	4	26
Boggs Township	0	51	0	1	0	0	0	0	0	1	0	4	1	1	0	1	59
Burnside Township	0	596	1	0	0	1	0	0	0	0	0	0	1	0	87	1	687
Centre Hall Borough	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	4
College Township	0	0	2	10	2	2	10	0	1	0	0	6	1	7	0	3	44
Curtin Township	0	185	1	0	0	0	0	0	0	0	0	0	0	0	7	1	194
Ferguson Township	1	0	3	7	0	0	3	0	0	3	1	6	0	2	0	1	24
Gregg Township	2	0	2	0	1	1	1	0	0	0	0	1	1	0	0	1	10
Haines Township	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	2	7
Halfmoon Township	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	5
Harris Township	0	0	3	0	0	1	1	0	0	1	0	1	0	0	0	1	7
Howard Borough	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	4
Howard Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Huston Township	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Liberty Township	0	2	1	1	0	0	0	0	0	0	0	1	2	0	0	1	8
Marion Township	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	4
Miles Township	0	0	1	0	1	1	0	0	0	0	0	9	0	1	0	2	15
Milesburg Borough	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	2
Millheim Borough	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	4

Table 2.5-2: Critical Facilities by Municipality and Type

MUNICIPALITY	AIRPORT	CONVENTIONAL WELL	DAMS	DAY CARE CENTER	EMS	FIRE STATIONS	HOSPITALS AND MEDICAL CENTERS	JAILS	NURSING HOMES	PERSONAL CARE	POLICE STATIONS	SCHOOLS	SEWER TREATMENT PLANTS	TRI FACILITY	UNCONVENTIONAL WELL	WATER TREATMENT PLANT	TOTAL
Patton Township	2	0	2	3	1	1	6	0	1	1	1	4	0	0	0	0	21
Penn Township	0	0	4	1	0	0	1	0	0	1	0	3	3	0	0	2	14
Philipsburg Borough	0	0	1	3	1	2	0	0	0	0	0	2	0	0	0	0	9
Port Matilda Borough	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	4
Potter Township	1	0	6	0	0	0	1	0	0	1	0	1	3	1	0	1	14
Rush Township	1	47	9	1	1	1	2	0	1	0	1	1	3	1	13	5	87
Snow Shoe Borough	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2
Snow Shoe Township	0	527	2	0	1	0	1	0	0	0	0	0	2	1	88	1	623
Spring Township	1	0	0	2	0	0	3	0	0	0	1	4	2	5	0	1	19
State College Borough	0	0	0	13	2	1	2	0	2	2	2	11	1	0	0	0	34
Taylor Township	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Union Township	1	7	0	0	0	0	0	0	0	0	0	0	1	0	0	3	12
Unionville Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walker Township	0	0	0	2	0	2	0	0	0	0	0	3	1	2	0	4	14
Worth Township	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	5
Grand Total	11	1,421	48	53	15	22	33	4	6	11	9	71	24	26	195	46	1,984

3. PLANNING PROCESS

3.1 UPDATE PROCESS AND PARTICIPATION SUMMARY

The Centre County HMP was originally developed in 2004 by the Centre County OES. The HMP was then updated and adopted for implementation in 2010 and 2015. The 2004 Plan, 2010 Plan, 2015 Plan, and the updated 2021 Centre 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. Michael Baker International assisted the County and its municipalities throughout the update process.

In 2015, the Centre County (HMSC), consisting of Centre County OES and Centre County Planning and Community Development Office (CCPCDO) staff, was responsible for the development of 2015 HMP Update in partnership with the Hazard Mitigation Planning Team (HMPT) that included representatives from the County's municipalities and communities. In 2020, OES received grant funding from FEMA to update the HMP. The HMSC was similarly responsible for the development of the 2021 update effort. The HMSC was again led by OES and CCPCDO. The 2021 HMPT included the Centre County municipalities, PSU, and other community representatives. All 35 municipalities in Centre County were considered in the vulnerability assessment and the development of the Mitigation Strategy to address these vulnerabilities. Details on the members of the HMSC and HMPT are included in Section 3.2 – The Planning Team.

To begin this process, OES and CCPCDO hosted an internal kick-off meeting with the contract support to begin the update process on April 14, 2020. During this meeting, attendees reviewed the Hazard Mitigation Planning process, as well as changes to that process promoted by PEMA's Standard Operating Guide issued in 2020. Additionally, the attendees discussed the scheduling of HMPT and public meetings and HMSC participation for the 2021 update process. Details on this and other meetings are included in Section 3.3 – Meetings and Documentation.

All 35 municipalities in Centre County met the participation requirements in the 2021 HMP Update process.

Detailed information about stakeholder participation is included in Section 3.4 – Public & Stakeholder Participation. The municipal involvement in developing the 2021 HMP Update is detailed in Section 3.5 – Multi-Jurisdictional Planning.

The HMSC used a number of worksheets to gather information from each municipality and participant in the planning process. These worksheets were designed to gather information about the hazards that affected the entire County, and how those hazards affected each of the municipalities, as well as information about the Mitigation Strategy. The use of these forms is detailed in Section 3.3 – Meetings and Documentation and the submitted forms are included in Appendix C – Meeting and Other Participation Documentation.

In accordance with the Disaster Mitigation Act (DMA) of 2000, the HMP Update documents the following topics:

- Planning Process;
- Hazard Identification;
- Risk Assessment;
- Mitigation Strategy: Goals, Objectives, and Actions;
- Formal Adoption by the Participating Jurisdictions; and
- PEMA and FEMA approval.

The report format is structured in accordance with the most current planning guidance from FEMA, Local Mitigation Handbook (2013), and PEMA, Commonwealth of Pennsylvania's All-Hazard Mitigation Planning Standard Operating Guide (SOG) (2020). The overall format between the 2021 HMP Update and the 2015 HMP Update has remained largely unchanged.

3.2 THE PLANNING TEAM

The HMPT assembled for the 2021 HMP included representatives from Centre County, the Centre County municipalities, Centre Region Council of Governments, and Penn State University. The HMSC was assembled to guide the overall direction of the HMP Update and make day-to-day decisions pertaining to its completion in conjunction with the Michael Baker consultant team.

Table 3.2-1 details the members of the 2021 HMSC. This steering committee follows a similar structure to that established for the 2015 update.

Table 3.2-1: Centre County 2021 HMSC Members

NAME	ORGANIZATION
Jody Lair	Centre County Office of Emergency Services
Ray Stolinas, AICP	Centre County Planning and Community Development Office
Elizabeth Lose	Centre County Planning and Community Development Office
Taryn Murray, CFM	Michael Baker International
Jessica Bodnar, AICP	Michael Baker International

The primary roles of the HMSC included providing outreach and coordination among participating jurisdictions, determining capability updates, and providing technical expertise and mitigation action development. In order to represent the diverse stakeholders in the County, the HMSC developed a list of HMPT members. The stakeholders listed in Table 3.2-2 served on the HMPT and actively participated in the planning process through attendance at meetings, completion of assessment surveys, or submission of comments. Participants representing multiple jurisdictions are listed more than once.

Table 3.2-2: 2021 Centre County HMPT Participants

MUNICIPALITY	PARTICIPANT(S)
Bellefonte Borough	Randy Brachbill, Council Member; Amy Everman, Deputy Executive Director, Bellefonte EMS; Scott Rhoat, Executive Director, Bellefonte EMS; Joanne Tosti-Vasey, Council President; Anne Walker, Council Member; Deborah Cleeton, Council Member
Benner Township	Sharon Royer, Secretary/Treasurer
Boggs Township	David Veneziano, Chair, Board of Supervisors; James L. Strunk Secretary/Treasurer
Burnside Township	Connie Holt, Local Emergency Management Coordinator
Centre Hall Borough	Beth Araujo, Secretary; Kathryn Long, Council President
College Township	Adam Brumbaugh, Township Manager; Shawn Kauffman, Centre Region Emergency Management Coordinator; Jere Northridge, Engineer; Lindsay Schoch, Principal Planner
Curtin Township	Lynn Harter, Secretary
Ferguson Township	Shawn Kauffman, Centre Region Emergency Management Coordinator; David Pribulka, Township Manager
Gregg Township	James Smith, Local Emergency Management Coordinator
Haines Township	Susan Wenrick, Secretary/Treasurer
Halfmoon Township	Denise Gembusia, Township Manager; Shawn Kauffman, Centre Region Emergency Management Coordinator
Harris Township	Amy Farkas, Township Manager; Shawn Kauffman, Centre Region Emergency Management Coordinator; Jere Northridge, Engineer
Howard Borough	Steve Nyman, Zoning Officer; Philip Winchell, Council President
Howard Township	Mark Ott, Local Emergency Management Coordinator
Huston Township	Karen Dillon-Ballock, Secretary
Liberty Township	Alyssa Doherty, Secretary; Michelle Wetzel, Secretary/Treasurer
Marion Township	Rich Moyle, Local Emergency Management Coordinator
Miles Township	Rick Bair, Secretary
Milesburg Borough	Paula Hall, Secretary
Millheim Borough	Robert Zeigler, Council President
Patton Township	Douglas Erikson, Township Manager; Shawn Kauffman, Centre Region Emergency Management Coordinator
Penn Township	Barbara Shaffer, Secretary/Treasurer
Philipsburg Borough	Shelley Walstrom, Secretary; Joel Watson, Borough Manager

Table 3.2-2: 2021 Centre County HMPT Participants

MUNICIPALITY	PARTICIPANT(S)
Port Matilda Borough	Ida Lively, Mayor; Mark Lively, Council Member
Potter Township	Dick Decker, Chairman
Rush Township	Michelle Merrow, Engineer
Snow Shoe Borough	Karen Basalla, Secretary; Tim Nilson, Emergency Management Coordinator; Sandra Reiter, Council Member
Snow Shoe Township	George Staco, Emergency Management Coordinator
Spring Township	Michael Danneker, Township Manager
State College Borough	Tom Fountaine, Borough Manager; Shawn Kauffman, Centre Region Emergency Management Coordinator
Taylor Township	Tim Reese, Township Supervisor
Union Township	Renee Swancer, Secretary
Unionville Borough	Renee Swancer, Secretary
Walker Township	Shannon Allison, Local Emergency Management Coordinator
Worth Township	Jadine Reese, Secretary
Centre County Planning and Community Development Office	Elizabeth Lose, Senior Planner; Anne Messner, Senior Transportation Planner; Ray Stolinas, Director
Centre Region Council of Governments	Pam Adams, Sustainability Planner; Shawn Kauffman, Centre Region Emergency Management Coordinator; Eric Norenberg, Executive Director
Centre County Conservation District	James Coslo, District Manager
Centre County Office of Emergency Services	Jody Lair, Deputy Director; Jeffrey A. Wharran, Director
Centre Regional Planning Agency	Pam Adams, Sustainability Planner; Tom Zilla, Principal Transportation Planner
Centre County GIS	Nick Barger, Director
Penn State University	Pam Soule, Emergency Management Planner

3.3 MEETINGS AND DOCUMENTATION

The following meetings were held during the HMP Update process. Invitations, agendas, sign-in sheets, and minutes for these meetings are included in Appendix C – Meeting and Other Participation Documentation.

April 14, 2020 – HMSC Kick-Off Meeting: This 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 documents for integration.

May 28, 2020 – HMPT Kick-Off Meeting: This meeting was held virtually due to mandated government restrictions related to the ongoing pandemic. Afternoon and evening sessions were offered to provide additional opportunity for participation. The meetings included

discussion of project scope, schedule, the planning process, participation and engagement, and next steps. Hazards from the 2015 Plan were reviewed with the HMPT. Mail and email invitations were sent to each Centre County municipality, as well as other area stakeholders including neighboring communities and relevant local and regional agencies. Meeting attendees were asked to fill out the "Evaluation of Identified Hazards and Risk" form to identify their jurisdictional risk to each hazard, the "Capability Assessment Survey" to inform the communities' abilities to implement the plan, and the "National Flood Insurance Program (NFIP) Survey" to gather input from the community on resources relative to participation in the NFIP.

September 24, 2020 – Risk Assessment and Mitigation Solutions Meeting: This meeting was held to discuss Centre County's hazard vulnerability and new hazards to be profiled in the 2021 HMP, as well as provide an overview of the Mitigation Strategy. Afternoon and evening sessions were offered to provide additional opportunity for participation. Meetings were held virtually due to mandated government restrictions with respect to the ongoing pandemic. Participants reviewed preliminary risk assessment results and discussed progress of mitigation actions from the 2015 HMP Update. The group also explored additional mitigation actions that would help reduce or eliminate potential losses. Mail and email invitations were sent to each municipality and other stakeholders on the HMPT, and a notice of the meeting was posted on the calendar of the project website. Meeting attendees were asked to fill out the "Jurisdictional Hazard Risk Ranking Form" to determine the vulnerability of the municipality to each risk compared to the assessed risk of the County and the "Mitigation Action Progress" and "New Mitigation Action" forms to identify progress on existing mitigation actions and any new mitigation actions.

October 21, 2020 – HMSC Review Meeting: This meeting was attended by County representatives and the consultant to discuss municipal participation to date, opportunities for public participation, and to conduct a comprehensive review of Mitigation Strategy including goals and objectives, mitigation action progress, and the identification of new actions.

January 7, 2021 – Draft Plan Review Public Meeting: This public meeting was held virtually due to mandated government requirements related to the pandemic response. The purpose of this final HMPT meeting was to provide information about the update process, evaluation, and general findings in the 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 to PEMA and FEMA. Afternoon and evening webinars were offered. Invitations were mailed and emailed to each municipality and stakeholders on the HMPT. The meeting was noticed on the website, and was advertised as a legal ad in the local newspaper, see Figure 3.4-1. Meeting attendees were asked to fill out Plan Comment forms, and the HMSC requested that Mitigation Action Progress and New Mitigation Action forms be completed by any municipality that had not done so already.

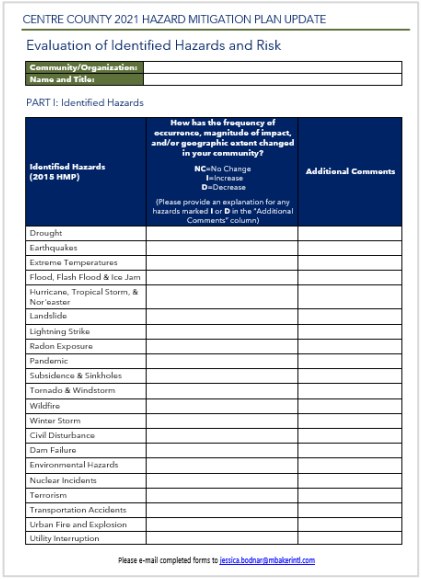
January 8, 2021 – Public Review: The draft 2021 HMP Update was posted to the project website on January 8, 2021 so the public could obtain information about the draft, review the HMP, and ask questions or provide comments and feedback. The availability of planning materials and Draft HMP review were advertised in the *Centre Daily News*. Additionally, notice was posted to the project website. A citizen's questionnaire and question/comment forms were available.

The HMSC utilized a variety of online tools and methods in order to provide ample opportunity for public participation and awareness of the HMP to accommodate public safety recommendations and government mandates related to the pandemic response.

3.4 PUBLIC AND STAKEHOLDER PARTICIPATION

Each municipality was given multiple opportunities to participate in the HMP Update process through invitation to above outlined meetings, review of risk assessment results and mitigation actions, and an opportunity to comment on a final draft of the 2021 HMP Update. The tools listed below were available on the HMP Update website to solicit information, data, and comments from both local municipalities and other key stakeholders in Centre County. These forms were also distributed by mail and email following the HMPT meetings identified. Responses to these worksheets and surveys are included in Appendix C – Meeting and Other Participation Documentation.

1. Evaluation of Identified Hazards and Risk Worksheet: Collects information from the Planning Team 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 Planning Team to identify any additional hazards they believe should be considered in the 2021 Plan.



CENTRE COUNTY 2021 HAZARD MITIGATION PLAN UPDATE

Evaluation of Identified Hazards and Risk

Community/Organization:	
Name and Title:	

PART I: Identified Hazards

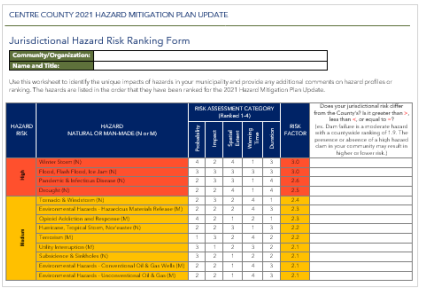
Identified Hazards (2015 HMP)	How has the frequency of occurrence, magnitude of impact, and/or geographic extent changed in your community? NC=No Change I=Increase D=Decrease (Please provide an explanation for any hazards marked I or D in the "Additional Comments" column)	Additional Comments
Drought		
Earthquakes		
Extreme Temperatures		
Flood, Flash Flood & Ice Jam		
Hurricane, Tropical Storm, & Nor'easter		
Landslide		
Lightning Strike		
Radon Exposure		
Pandemic		
Subsidence & Sinkholes		
Tornado & Windstorm		
Wildfire		
Winter Storm		
Civil Disturbance		
Dam Failure		
Environmental Hazards		
Nuclear Incidents		
Terrorism		
Transportation Accidents		
Urban Fire and Explosion		
Utility Interruption		

Please e-mail completed forms to jessica.bodnar@mbakerintl.com

2. Capability Assessment Survey: Collects information on local planning, regulatory, administrative, technical, fiscal, political, and resiliency capabilities that can be included in the plan's Capability Assessment section.

3. NFIP Survey: Collects information related to community capabilities towards aspects of the NFIP.

4. Jurisdictional Hazard Risk Ranking Form: Collects information on the perceived risk of hazards in each municipality compared to the ranked hazards for the County. Communities list whether the jurisdictional risk is greater, equal to, or less than the County's risk.



CENTRE COUNTY 2021 HAZARD MITIGATION PLAN UPDATE

Jurisdictional Hazard Risk Ranking Form

Community/Organization:	
Name and Title:	

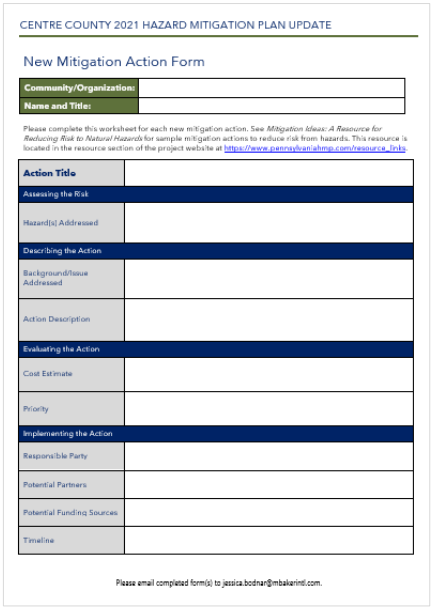
Use this worksheet to identify the unique impacts of hazards in your municipality and provide any additional comments on hazard profiles or ranking. The hazards are listed in the order that they have been ranked for the 2021 Hazard Mitigation Plan Update.

HAZARD RISK	HAZARD NATURAL OR MAN-MADE (N or M)	RISK ASSESSMENT CATEGORY (Ranked 1-4)					RISK FACTOR	Does your jurisdictional risk differ from the County's? Is it greater than >, less than <, or equal to =? (ex. Dam failure is a moderate hazard with a countywide ranking of 1.9. The presence or absence of a high hazard dam in your community may result in higher or lower risk.)
		Probability	Impact	Spatial Extent	Warning Time	Duration		
High	Winter Storm (N)	4	2	4	1	3	3.0	
	Flood, Flash Flood, Ice Jam (N)	3	3	3	3	3	3.0	
	Pandemic & Infectious Disease (N)	3	3	3	3	4	3.4	
	Drought (N)	2	2	4	1	4	2.5	
Medium	Tornado & Windstorm (N)	2	3	2	4	1	2.4	
	Environmental Hazards - Hazardous Materials Release (M)	2	2	2	4	1	2.3	
	Opioid Addiction and Response (M)	4	2	1	2	1	2.3	
	Hurricane, Tropical Storm, Nor'easter (N)	2	2	3	1	1	2.2	
	Terrorism (M)	1	3	2	4	2	2.2	
	Utility Interruption (M)	3	1	2	3	2	2.1	
	Subsidence & Sinkholes (N)	3	2	1	2	2	2.1	
	Environmental Hazards - Conventional Oil & Gas Wells (M)	2	2	1	4	1	2.1	
	Environmental Hazards - Unconventional Oil & Gas (M)	2	2	1	4	1	2.1	

5. **Mitigation Action Progress Form:** This form is specific to each jurisdiction and includes all actions for that jurisdiction in the 2015 HMP. Space is provided to note the current status of each action and to document any progress made.

6. **New Mitigation Action Form:** Allows communities to propose new mitigation actions for the HMP Update. This form collects details about the action, including priority, responsible parties, potential funding sources, implementation timeframe, and more.

7. **Plan Comment Form:** Provides an opportunity for communities to comment on any part of the planning process, mitigation strategy, risk assessment or other aspect of the HMP Update.



CENTRE COUNTY 2021 HAZARD MITIGATION PLAN UPDATE

New Mitigation Action Form

Community/Organization:	
Name and Title:	

Please complete this worksheet for each new mitigation action. See *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* for sample mitigation actions to reduce risk from hazards. This resource is located in the resource section of the project website at https://www.pennsylvaniahmp.com/resource_links

Action Title	
Assessing the Risk	
Hazard(s) Addressed	
Describing the Action	
Background/Issue Addressed	
Action Description	
Evaluating the Action	
Cost Estimate	
Priority	
Implementing the Action	
Responsible Party	
Potential Partners	
Potential Funding Sources	
Timeline	

Please email completed form(s) to jessica.bodnar@mbakerintl.com.

Community participation and comment was encouraged throughout the planning process, particularly through the project website: https://www.pennsylvaniahmp.com/centre-hmp. This site was created and made publicly available at the beginning of the planning process and acted as a repository for the entire planning process. The website houses presentations, agendas, minutes, and worksheets from each meeting as well as promulgated meeting dates and important announcements. Since the site was published in May 2020, it has received a total of 516 pageviews. The HMSC also developed a Community Hazard Mitigation Survey intended to solicit public input regarding the understanding of hazard risk, which was posted to the website. The survey received three responses.

PUBLIC NOTICE

Hazard Mitigation Plan Review for Centre County, Pennsylvania

Notice is hereby given that the Centre County Office of Emergency Services, in cooperation with the Office of Planning and Community Development, will hold public meetings to review the Draft Centre County Hazard Mitigation Plan on Thursday, January 7, 2021 from 2:00 PM – 3:00 PM and 7:00 PM – 8:00 PM. This Plan describes and assesses local hazards and risks and identifies actions that can be taken to reduce community risk and impacts. This meeting will be held virtually in recognition of concern for and commitment to public safety. For information on accessing this meeting, please visit the project website at ww w.pennsylvaniahmp.com/centre-hmp.

The Draft Centre County Hazard Mitigation Plan will be available for public review and comment beginning Friday, January 8, 2021 through Monday, February 8, 2021. Interested persons may access the Draft Plan and other informational materials by visiting the project website. The County also encourages residents to take a quick, three-minute Community Hazard Mitigation Survey located on the website.

Additional questions may be directed to Jody Lair, Deputy Director, Centre County Office of Emergency Services, at 814-355-6745 or jlair@centrecountypa.gov or contact Jessica Bodnar, Mitigation Planner, at jessica.bodnar@mbakerintl.com or 215-861-9320.

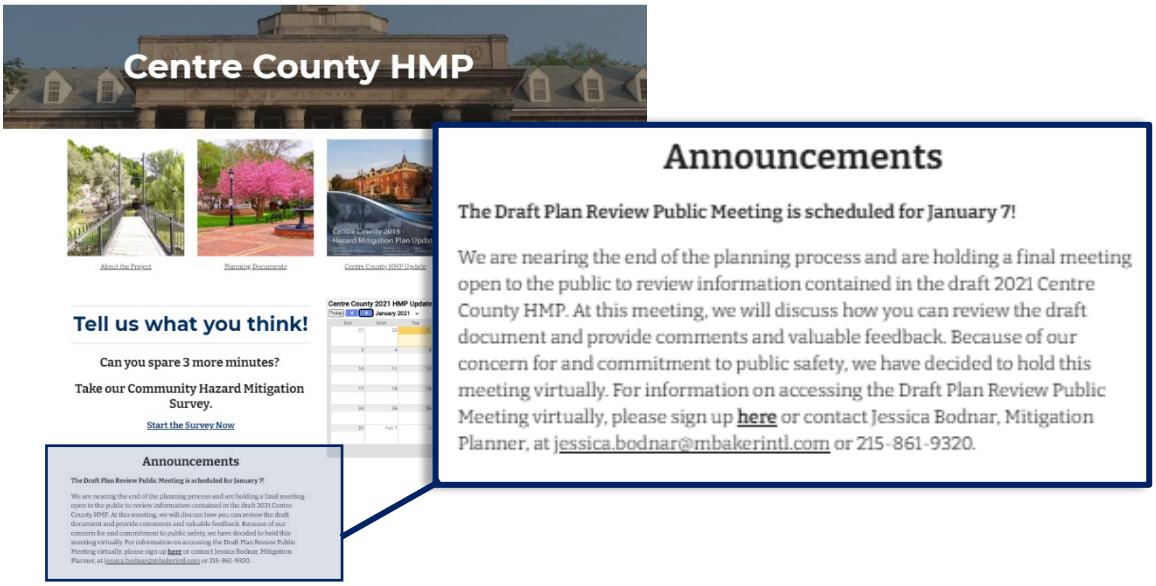
Figure 3.4-1: Public Notice of the Draft Plan Review Public Meeting *(included in Appendix C)*

A newspaper notice was published in the *Centre Daily News* on December 18, 2020 and an announcement was posted on the project website to notify the citizens of Centre County of the public meeting held on January 7, 2021, see Figure 3.4-1 for a copy of the newspaper notice and Figure 3.4-2 for the meeting notice on the project website. All invitations and notices are included in Appendix C – Meeting and Other Participation Documentation.

Centre County posted the 2021 draft HMP Update on the project website for review and comment on January 8, 2021 for a 30-day comment period. The invitation to the public to review and comment on the draft plan was posted on the project website and in the local newspaper. The draft HMP Update was also posted on the County's website.

Comments were to be submitted via the online comment form or in writing to the Centre County OES and/or to Jessica Bodnar of Michael Baker International by mail or email. Copies of all comments received are located in Appendix C – Meeting and Other Participation Documentation.

Figure 3.4-2: Notice of HMP Meetings Posted on the Project Website



3.5 MULTI-JURISDICTIONAL PLANNING

This HMP was developed using a multi-jurisdictional approach. Although County-level departments have resources such as technical expertise and data that 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. The HMSC and HMPT was committed to garnering municipal participation. Table 3.5-1 lists jurisdictional participation in this HMP Update. All of the County's 35 municipalities participated in the HMP Update process, achieving 100 percent participation.

The Kick-Off Meeting, Risk Assessment and Mitigation Solutions Meeting, and Draft Plan Review Meeting were all held virtually as a result of the ongoing pandemic. All meetings had afternoon and evening meeting sessions to maximize participation. Each municipality was mailed and emailed invitations and reminders to all meetings. Surveys and forms were provided at meetings, posted to the project website, or emailed or mailed to jurisdictions.

It should be noted that many communities in Centre County have little to no broadband access. Some communities had difficulty participating in a virtual setting while dealing with COVID-19 restrictions. For example, local officials might need to travel to a nearby community with internet access in order to attend a virtual meeting. Municipalities in Centre County typically have robust participation in HMP Updates. However, the combination of COVID-19 restrictions and internet access issues created a barrier for participation during this plan update process.

Table 3.5-1: 2021 Centre County Municipal Participation

MUNICIPALITY	COUNTY HMP MEETINGS			WORKSHEETS AND EXERCISES						
	Hazard Mitigation Plan Kick-Off Meeting	Risk Assessment and Mitigation Solutions Workshop	Public Meeting	Evaluation of Identified Hazards and Risk Worksheet	Capability Assessment Survey	NFIP Compliance and Capabilities Survey	Jurisdictional Hazard Risk Ranking Form	Mitigation Action Progress Form	New Mitigation Action Form	Plan Comment
Bellefonte Borough	X	X	X							
Benner Township	X	X	X	X	X	X	X	X		
Boggs Township	X	X	X				X	X	X	
Burnside Township				X	X		X	X		
Centre Hall Borough	X	X	X	X	X	X	X	X	X	
College Township	X	X	X		X		X	X	X	X
Curtin Township				X	X		X	X		
Ferguson Township	X	X	X	X	X	X	X	X	X	X
Gregg Township	X			X	X		X	X		
Haines Township		X	X	X	X	X	X	X	X	
Halfmoon Township	X	X	X		X	X	X	X	X	X
Harris Township	X	X	X		X		X	X	X	X
Howard Borough		X	X	X	X	X	X	X	X	
Howard Township		X	X	X	X	X	X		X	
Huston Township				X	X		X	X		
Liberty Township	X							X		
Marion Township				X	X		X	X		
Miles Township	X	X	X	X	X	X		X	X	X
Milesburg Borough				X	X	X	X	X	X	

Table 3.5-1: 2021 Centre County Municipal Participation

MUNICIPALITY	COUNTY HMP MEETINGS			WORKSHEETS AND EXERCISES						
	Hazard Mitigation Plan Kick-Off Meeting	Risk Assessment and Mitigation Solutions Workshop	Public Meeting	Evaluation of Identified Hazards and Risk Worksheet	Capability Assessment Survey	NFIP Compliance and Capabilities Survey	Jurisdictional Hazard Risk Ranking Form	Mitigation Action Progress Form	New Mitigation Action Form	Plan Comment
Millheim Borough	X		X	X	X	X	X	X		
Patton Township	X	X	X	X	X	X	X	X	X	X
Penn Township	X	X	X	X	X	X	X	X	X	
Philipsburg Borough				X	X	X	X	X	X	
Port Matilda Borough		X								
Potter Township	X	X	X	X	X	X		X	X	X
Rush Township	X	X	X							
Snow Shoe Borough	X	X		X	X		X	X		
Snow Shoe Township				X	X	X	X	X	X	
Spring Township	X	X	X	X	X	X	X	X	X	
State College Borough	X	X	X		X		X	X	X	X
Taylor Township	X									
Union Township	X			X	X	X	X	X		
Unionville Borough	X			X	X	X	X	X		
Walker Township		X								
Worth Township				X	X	X				
Penn State University	X	X		X	X			X		

4. RISK ASSESSMENT

4.1 UPDATE PROCESS SUMMARY

This Risk Assessment provides a factual basis for activities proposed by the County in their Mitigation Strategy. Hazards that may affect Centre County are identified and defined in terms of location and geographic extent, magnitude of impact, previous events, and the likelihood of future occurrence. Wherever data could be validated, information from the previous plan has been incorporated and/or updated in the 2021 HMP. In addition, new data sources and analysis have been incorporated throughout the Risk Assessment.

The 2004 Centre County HMP included a list of eight natural and seven human-made hazards affecting the County. In the 2010 HMP, the HMSC added 4 hazards: Extreme Temperature, Lighting Strike, Pandemic, and Earthquake. For the 2015 HMP, the HMSC identified and included the following hazards updates: added Oil and Gas Extraction to Environmental Hazards and added Radon Exposure as an additional hazard. In addition, both the 2010 and 2015 Plans re-arranged the hazard profiles to be compliant with the Commonwealth of Pennsylvania's Standard Operating Guide.

For the 2021 Plan Update, the HMSC reviewed the previously identified hazards and ensured that they remained currently relevant hazards. The HMSC also reviewed the updated Pennsylvania Standard List of Hazards for consideration in the updated Risk Assessment. Following this review, two hazards identified for inclusion in the Plan Update: Cyber Terrorism and Opioid Addiction. The decision was based on recent occurrences of these types of events in the County and throughout the Commonwealth. Additionally, per PEMA's updated 2020 SOG, the Environmental Hazards profiled in the 2015 Plan were separated into three distinct profiles. Table 4.1-1 provides the list of the hazards identified and included in the 2021 HMP, and the year they were first identified for inclusion.

Table 4.1-1: Natural and Human-Made Hazards by Year Identified for Inclusion in Centre County HMP

HAZARD	YEAR	HAZARD	YEAR
Civil Disturbance	2004	Nuclear Incident	2004
Cyber Terrorism	2021	Opioid Addiction	2021
Dam Failure	2004	Pandemic and Infectious Disease	2010
Drought	2004	Radon Exposure	2015
Earthquake	2010	Subsidence, Sinkhole	2004
Environmental Hazards - Hazardous Materials Release*	2004	Terrorism	2004
Environmental Hazards - Conventional Oil & Gas Wells*	2015	Tornado, Windstorm	2004
Environmental Hazards - Unconventional Oil & Gas Wells *	2015	Transportation Accidents	2004

Table 4.1-1: Natural and Human-Made Hazards by Year Identified for Inclusion in Centre County HMP

HAZARD	YEAR	HAZARD	YEAR
Extreme Temperature	2010	Urban Fire and Explosion	2004
Flood, Flash Flood, Ice Jam	2004	Utility Interruption	2004
Hurricane, Tropical Storm, Nor'easter	2004	Wildfire	2004
Landslide	2004	Winter Storms	2004
Lighting Strike	2010		

*Hazards were previously categorized under one Environmental Hazards profile in the 2015 HMP.

After the HMSC identified the hazards, they developed risk profiles in order to define the characteristics of the hazard as it applies to Centre County. Following hazard identification and profiling, a vulnerability assessment was performed to identify the impact of natural or human-made hazard events on people, buildings, infrastructure, and the community. Each natural and human-made hazard is discussed in terms of its potential impact on individual communities in Centre County, including the types of structures and infrastructure 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 may consist of an inventory of vulnerable structures or populations.

4.2 HAZARD IDENTIFICATION

4.2.1 Table of Presidential Disaster Declarations

Under the Stafford Act, there are two forms of presidential action that authorize federal disaster assistance dollars. Presidential Emergency Declarations are intended to spur activities that will protect property and strengthen public safety to lessen impacts or avoid a catastrophic event. Presidential Disaster Declarations are made as a result of a disaster event and provide supplemental coordination and financial assistance beyond the ability of state and local governments (McCarthy, 2011). Because of the difference in these declarations, a single event may qualify for both kinds of declarations.

There is no financial threshold for an Emergency Declaration, but there are two thresholds for Presidential Disaster Declarations established under the Stafford Act: a state and a county threshold. These thresholds are based on a formula that uses the population of the jurisdiction (as recorded in the decennial Census) times a set per capita indicator. For federal fiscal year 2021, these thresholds are $3.89 per capita for counties and $1.55 per capita for the state. With a population of over 150,000, the Centre County threshold is over half a million dollars. State and county thresholds must be simultaneously attained for a Presidential Disaster Declaration to be issued.

Table 4.2.1-1 identifies Presidential Disaster and Emergency Declarations that have affected Centre County from most to least recent.

Table 4.2.1-1: Presidential Disaster and Emergency Declarations affecting Centre County (FEMA, 2020a)

DECLARATION NUMBER	DATE	EVENT
4506	March 2020	COVID-19 Pandemic
3441	March 2020	COVID-19 Pandemic
4292	December 2016	Severe Storms, Flooding
4149	October 2013	Severe Storms, Tornadoes, Flooding
3356*	October 2012	Hurricane Sandy
3340*	August 2011	Flooding; Remnants of Tropical Storm Lee
3235*	September 2005	Hurricane Katrina Evacuee Assistance
1557	September 2004	Tropical Depression Ivan
1555	September 2004	Severe Storms and Flooding associated with Tropical Depression Frances
1093	January 1996	Flooding
1085	January 1996	Severe Winter Storm
1015	January 1994	Severe Winter Storm
3105*	March 1993	Severe Winter Storm
485	September 1975	Hurricane Eloise
340	June 1972	Hurricane Agnes

** Presidential Emergency Declaration*

Since 1955, declarations have been issued for various hazard events including hurricanes or tropical storms, severe summer and winter storms, flooding and drought. 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 Centre County, were indirectly affected by Hurricane Katrina as a result of evacuee assistance.

4.2.2 Summary of Hazards

The HMSC was provided the Pennsylvania Standard List of Hazards to consider for evaluation in the 2021 HMP. Following a review of the hazards evaluated in the 2004, 2010, and 2015 HMPs and the Standard List of Hazards, the HMSC along with input from the HMPT decided that the 2021 Plan should identify, profile, and analyze 25 hazards. These 25 hazards include all hazards profiled in the 2015 Plan with the addition of Cyber Terrorism and Opioid Addiction as hazards, and splitting Environmental Hazards (Hazardous Materials Release, Conventional Oil and Gas Wells, and Unconventional Oil and Gas Wells) into three separate hazards.

Table 4.2.2-1 contains a complete list of the 25 hazards that have the potential to impact Centre County as identified through previous Risk Assessments, the County Hazards Vulnerability

Analysis, and input from those that participated in the 2021 HMP Update. Hazard profiles are included in Section 4.3 for each of these hazards.

Table 4.2.2-1: Descriptions of Natural and Human-Made Hazard Profiled in the 2021 HMP Update (PEMA, 2020)

PROFILED HAZARD	HAZARD DESCRIPTION
NATURAL	
Drought	Drought is defined as a deficiency of precipitation experienced over an extended period of time, usually a season or more. Droughts increase the risk of other hazards, like wildfires, flash floods, and landslides or debris flows. This hazard is of particular concern in Pennsylvania due to the prevalence of farms and other water-dependent industries, water-dependent recreation uses, and residents who depend on wells for drinking water.
Earthquake	An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area.
Extreme Temperature	Extreme heat often results in the highest number of annual deaths of all weather-related hazards. In most of the United States, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. (Ready.gov, 2018). Extremely cold air comes every winter in at least part of the country and affects millions of people across the United States. The arctic air, together with brisk winds, can lead to dangerously cold wind chill values. People exposed to extreme cold are susceptible to frostbite and hypothermia in a matter of minutes.
Flood, Flash Flood, Ice Jam	Flooding is the temporary condition of partial or complete inundation of normally dry land, and it is the most frequent and costly of all natural hazards in Pennsylvania. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams.
Hurricane, Tropical Storm, Nor'easter	Hurricanes, tropical storms, and nor'easters are classified as cyclones and are any closed circulation developing around a low-pressure center in which the winds rotate counterclockwise (in the Northern Hemisphere) and whose diameter averages 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.

Table 4.2.2-1: Descriptions of Natural and Human-Made Hazard Profiled in the 2021 HMP Update (PEMA, 2020)

PROFILED HAZARD	HAZARD DESCRIPTION
Landslide	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.
Lightning Strike	Lightning is a giant spark of electricity resulting from the build-up of positive and negative charges within a thunderstorm. The flash or "bolt" of light can occur within the thunderstorm cloud or between the cloud and the ground. Lightning is a leading cause of injury and death from weather-related hazards. Although most lightning victims survive, people struck by lightning often report a variety of long-term, debilitating symptoms.
Pandemic and Infectious Disease	A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner, and causing serious illness. An epidemic describes a smaller-scale infectious outbreak, within a region or population, that emerges at a 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.
Radon Exposure	Radon is a radioactive gas produced by the breakdown of uranium in soil and rock that can lead to lung cancer in people exposed over a long period of time. Most exposure comes from breathing in radon gas that enters homes and buildings through foundation cracks and other openings. According to the DEP, approximately 40% of Pennsylvania homes have elevated radon levels.
Subsidence, Sinkhole	Land subsidence is a gradual settling or sudden sinking of the ground surface due to the movement of subsurface materials. A sinkhole is a subsidence feature resulting from the sinking of surficial material into a pre-existing subsurface void. Subsidence and sinkholes are geologic hazards that can impact roadways and buildings and disrupt utility services. Subsidence and sinkholes are most common in areas underlain by limestone and can be exacerbated by human activities such as water, natural gas, and oil extraction.
Tornado, Windstorm	A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. About 1,250 tornadoes hit the United States each year, with about 16 hitting Pennsylvania. Damaging winds exceeding 50-60 miles per hour can occur during tornadoes, severe thunderstorms, winter storms, or coastal storms. These winds can have severe impacts on buildings, pulling off the roof covering, roof deck, or wall siding and pushing or pulling off the windows.
Wildfire	A wildfire is an unplanned fire that burns in a natural area. Wildfires can cause injuries or death and can ruin homes in their path. Wildfires can be caused by humans or lightning, and can happen anytime, though the risk increases in period of little rain. In Pennsylvania, 98% of wildfires are caused by people.

Table 4.2.2-1: Descriptions of Natural and Human-Made Hazard Profiled in the 2021 HMP Update (PEMA, 2020)

PROFILED HAZARD	HAZARD DESCRIPTION
Winter Storm	A winter storm is a storm in which the main types of precipitation are snow, sleet, or freezing rain. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Most deaths from winter storms are not directly related to the storm itself, but result from traffic accidents on icy roads, medical emergencies while shoveling snow, or hypothermia from prolonged exposure to cold.
HUMAN-MADE	
Civil Disturbance	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.
Cyber Terrorism	Cyber terrorism refers to acts of terrorism committed using computers, networks, and the Internet. The most widely cited definition comes from Denning's Testimony before the Special Oversight Panel on Terrorism: "Cyberterrorism…is generally understood to mean unlawful attacks and threats of attack against computers, networks, and the information stored therein when done to intimidate or coerce a government or its people in furtherance of political or social objectives. Further, to qualify as cyberterrorism, an attack should result in violence against persons or property, or at least cause enough harm to generate fear."
Dam Failure	Dam failure is the uncontrolled release of water (and any associated wastes) from a dam. This hazard often results from a combination of natural and human causes, and can follow other hazards such as hurricanes, earthquakes, and landslides. The consequences of dam failures can include property and environmental damage and loss of life.
Environmental Hazards - Hazardous Materials Release	Hazardous material releases can contaminate air, water, and soils and have the potential to cause injury or death. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events.
Environmental Hazards - Conventional Oil & Gas Wells	Many of the hazards associated with conventional oil and gas extraction relate to the contamination of surface and subsurface waters. Abandoned oil and gas wells that are not properly plugged can contaminate groundwater and pollute domestic drinking water wells. In addition, surface waters and soil can be contaminated by brine, a salty wastewater product of oil and gas well drilling, or by oil spills. This pollution can degrade public drinking water supplies and disrupt aquatic ecosystems.
Environmental Hazards - Unconventional Oil & Gas Wells	In addition to the hazards associated with conventional oil and gas extraction, potential hazards from Marcellus Shale gas wells include surface water depletion affecting drinking water supplies and aquatic ecosystems; contaminated surface and groundwater resulting from hydraulic fracturing and the recovery of contaminated hydraulic fracturing fluid; and mishandling of solid toxic waste.

Table 4.2.2-1: Descriptions of Natural and Human-Made Hazard Profiled in the 2021 HMP Update (PEMA, 2020)

PROFILED HAZARD	HAZARD DESCRIPTION
Nuclear Incident	Nuclear explosions can cause significant damage and casualties from blast, heat, and radiation. The primary concern following a nuclear accident or nuclear attack is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects.
Opioid Addiction	Opioid addiction occurs when an individual becomes physically dependent on opioids, which include opiates and narcotics. Opioids are a synthetic substance found in certain prescription pain medications: morphine, codeine, methadone, oxycodone, hydrocodone, fentanyl, and hydromorphone, and street drugs like heroine. Opioids block the body's ability to feel pain and can create a sense of euphoria. Individuals often build a tolerance to opioid drugs, which leads them to take more of the medication than originally prescribed.
Terrorism	Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons. Cyber-attacks have become an increasingly pressing concern.
Transportation Accidents	Transportation accidents are technological hazards involving the nation's system of land, sea, and air transportation infrastructure. A flaw or breakdown in any component of this system can and often does result in a major disaster involving loss of life, injuries, property and environmental damage, and economic consequences.
Urban Fire and Explosion	Urban fire and explosion hazards include vehicle and building/structure fires as well as overpressure rupture, overheat, or other explosions that do not ignite. This hazard occurs in denser, more urbanized areas statewide and most often occurs in residential structures. Nationally, fires cause over 3,000 deaths and approximately 16,000 injuries each year.
Utility Interruption	Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications, public works, and information network sectors. Utility interruption hazards include the following: • Geomagnetic Storms • Fuel or Resource Shortage • Electromagnetic Pulse • Information Technology Failure • Ancillary Support Equipment • Public Works Failure • Telecommunications System Failure • Transmission Facility or Linear Utility Accident • Major Energy, Power, Utility Failure

4.3 HAZARD PROFILES

NATURAL HAZARDS

4.3.1 Drought

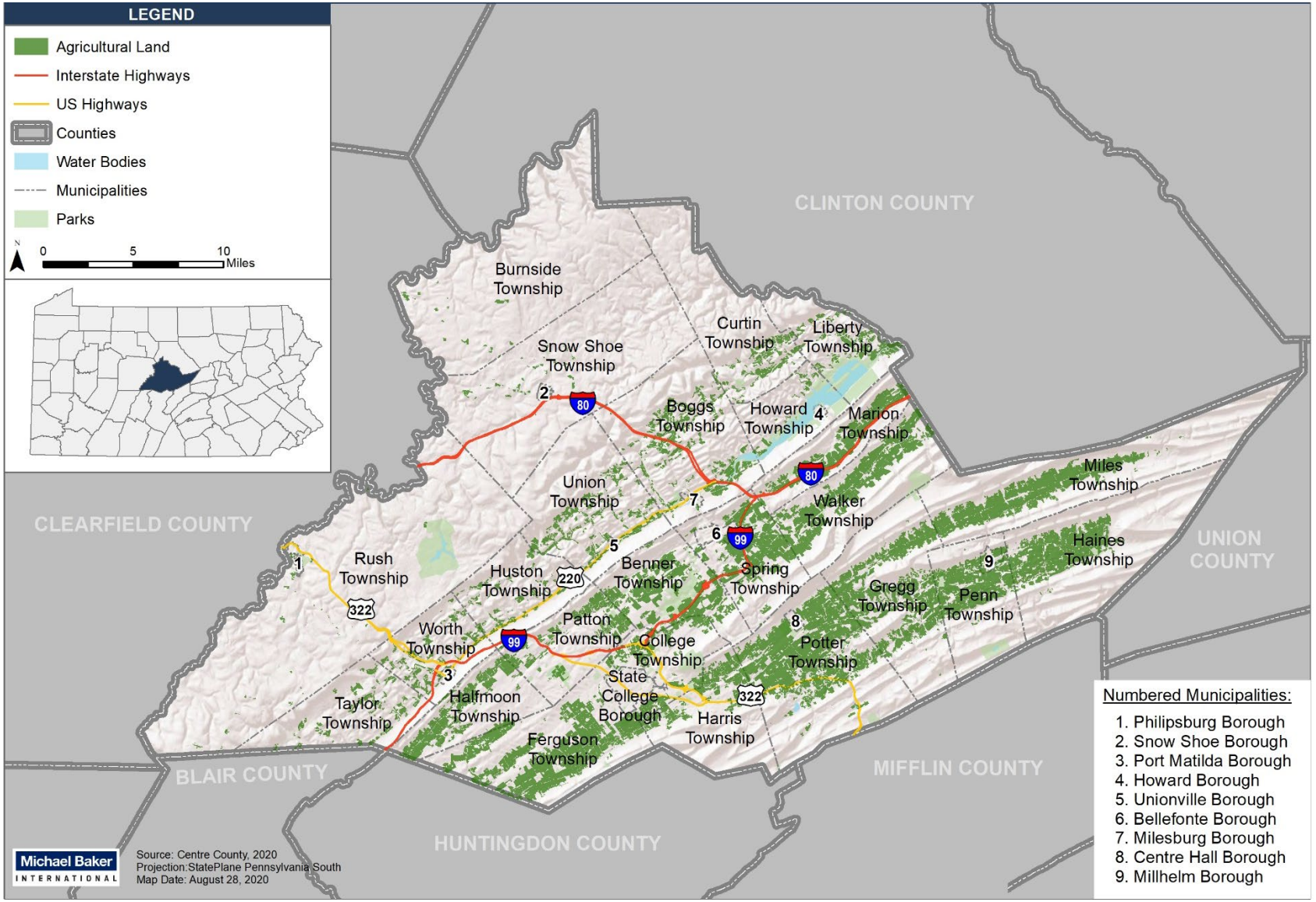
Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate 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 impact these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses (NDMC, 2020). There are two types of droughts that Centre County is concerned with; 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 Centre 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 central Pennsylvania to the entire mid-Atlantic region. Locations of droughts nationwide are monitored continuously by USGS, and the PA DEP monitors conditions throughout the 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. As this plan was being developed between May 2020 and February 2021, Centre County experienced a period of moderate drought watch (PA DEP, 2020a).

Areas with extensive agricultural land use can experience particularly significant impacts. As shown in Figure 4.3.1-1, these areas are concentrated in the central and southeastern parts of Centre County.

Figure 4.3.1-1: Centre County Agricultural Land Use, 2020



4.3.1.2 Range of Magnitude

Droughts can have varying effects, depending on the month in which 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 a lowering of groundwater levels. These events have adverse impacts on public water supplies for human consumption, rural water supplies for livestock consumption and agricultural operations, water quality, natural soil water or irrigation water for agriculture, soil moisture, conditions conducive to wildfire events, and water for navigation and recreation.

The Commonwealth uses five parameters to assess drought conditions:

1. Stream flows (compared to benchmark records)
2. Precipitation (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 4.3.1-1)

Table 4.3.1-1: Palmer Drought Severity Index (PSDI) Classifications (NOAA, 2020a)

SEVERITY CATEGORY	PSDI VALUE
Extremely wet	4.0 or more
Very wet	3.0 to 3.9
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

Data provided by Cornell University show that drought conditions in the Central Mountains region of Pennsylvania have resulted in PDSI level as low as -6.4. This was during a drought that lasted for 10 months from 1930 through 1931. In the Centre County area, the average PDSI level for droughts is -3.9 and the average duration of a drought is 3.4 months.

In Pennsylvania, PEMA has primary responsibility for managing droughts with direct support from the DEP. According to 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. Due to varying conditions, individual water suppliers or municipalities may be asking for more stringent conservation actions.
- 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. Due to varying conditions, individual water suppliers or municipalities may be asking for more stringent conservation actions.
- 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 fifteen 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.
- Local Water Rationing: 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.

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
- Reduced soil quality
- 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.

The drought of 2002 typifies drought impacts across Centre County's agricultural community and could be considered a worst-case drought event for the County. Data from the Pennsylvania Agricultural Statistics Service indicated that crop yields were down almost 30 percent for corn and soybeans. The diminished ability to produce feed corn for cattle also impacted dairy farmers that year. The reduced acreage farmers use, often diminished due to development pressures, impacted their resiliency to this drought event and economic hardships were endured. In response to drought conditions, the HMSC reported that the County did not have difficulty in compliance with the voluntary five-percent reductions in non-essential water use that are established during persistent drought events.

4.3.1.3 Past Occurrence

Declared drought status for Centre County from November 1980 to May 2017 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. As seen in the table, between 1930 and 2009, the Commonwealth of Pennsylvania experienced seven significant droughts extending from 1930-1934, 1939-1942, 1953-1955, 1961-1967, 1980-1983, 1991-1992 and 1999-2003. These were considered emergency events. 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, 1989, 1991, 1995, 1998, and early 1999.

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 experience water deficiencies during periods of below average rainfall. For example, the State College area resolved water supply problems by developing additional ground water sources that continue to exceed the need for the foreseeable future.

Table 4.3.1-2: Centre County Declared Drought Status from 1980 to 2017 (PA DEP, 2017)

DATE	DROUGHT STATUS	DATE	DROUGHT STATUS
Nov 18, 1980 - Apr 20, 1982	Emergency	Jun 18, 1999 - July 20, 1999	Warning
Apr 26, 1985 - Jul 29, 1985	Watch	Jul 20, 1999 - Sep 30,1999	Emergency
Jul 29, 1985 - Oct 22, 1985	Watch	Sep 30, 1999 - Dec 16, 1999	Warning
Oct 22, 1985 - Oct 29, 1985	Emergency	Dec 16, 1999 - Feb 25, 2000	Warning
Oct 29, 1985 - Dec 19, 1985	Emergency	Feb 25, 2000 - May 5, 2000	Watch
Jul 7, 1988 - Aug 24, 1988	Watch	Aug 8, 2001 - Aug 24, 2001	Watch
Aug 24, 1988 - Dec 12, 1988	Warning	Aug 24, 2001 - Nov 6, 2001	Watch
Mar 3, 1989 – May 15, 1989	Watch	Nov 6, 2001 - Dec 5, 2001	Watch
Jun 28, 1991 - Jul 24, 1991	Warning	Dec 5, 2001 - Feb 12, 2002	Watch
Jul 24, 1991 - Aug 16, 1991	Emergency	Feb 12, 2002 - May 13, 2002	Watch
Aug 16, 1991 - Sep 13, 1991	Emergency	May 13, 2002 - Jun 14, 2002	Watch
Sep 13, 1991 - Oct 21, 1991	Emergency	Sep 5, 2002 - Nov 7, 2002	Watch
Oct 21, 1991 - Jan 16, 1992	Emergency	Apr 11, 2006 - Jun 30, 2006	Watch
Jan 17, 1992 - Apr 20, 1992	Emergency	Aug 8, 2007 - Sep 5, 2007	Watch
Apr 20, 1992 - Jun 23, 1992	Warning	Sep 5,2007 – Oct 5, 2007	Watch
Sep 1, 1995 - Sep 20, 1995	Warning	Oct 5, 2007 – Jan 11, 2008	Watch
Sep 20, 1995 - Nov 8, 1995	Emergency	Jan 11, 2008 - Feb 15, 2008	Watch
Nov 8, 1995 - Dec 18, 1995	Warning	Nov 7, 2008 – Jan 26, 2009	Watch
Jul 17, 1997 - Oct 27, 1997	Watch	Sept 16, 2010 - Nov 10 2010	Watch
Oct 27, 1997 - Nov 13, 1997	Watch	Aug 5, 2011 - Sept 2, 2011	Watch
Dec 3, 1998 - Dec 8, 1998	Warning	June 17, 2015 – July 10, 2015	Watch
Dec 8, 1998 - Dec 14, 1998	Warning	Aug 2, 2016 – Sep 6, 2016	Watch
Dec 14, 1998 - Dec 16, 1998	Warning	Sep 6, 2016 – Nov 3, 2016	Watch
Dec 16, 1998 - Jan 15, 1999	Warning	Nov 3, 2016 – Dec 16, 2016	Watch
Jan 15, 1999 - Mar 15, 1999	Warning	Dec 16, 2016 – Feb 14, 2017	Watch
Mar 15, 1999 - Jun 10, 1999	Watch	Feb 14, 2017 – Apr 6, 2017	Watch
Jun 10, 1999 - Jun 18, 1999	Warning	Apr 6, 2017 – May 16, 2017	Watch

According to the PA DEP's Watershed Management Drought Information Center, the County has had 23 drought watches and two drought warnings in the period since the last drought emergency that ended in September of 1999. As shown in Table 4.3.1-2, Centre County has not had a declared drought warning or emergency since Winter 2000; however, some of the

agricultural lands have experienced loss due to drought conditions, such as in 2002. Since the 2015 Plan Update, there have been 6 drought watches (PA DEP, 2020a).

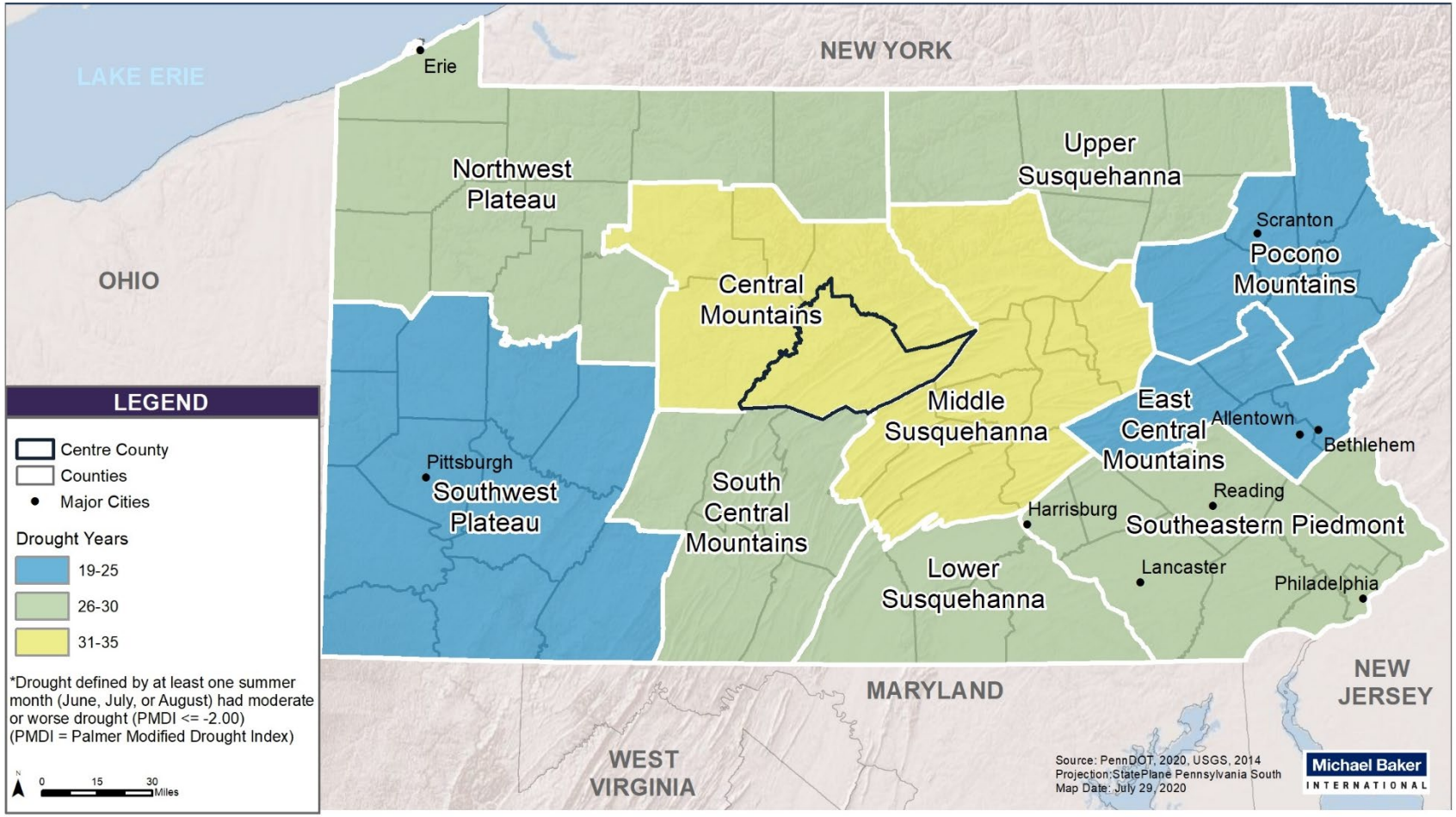
The U.S. Department of Agriculture (USDA) Risk Management Agency operates and manages the Federal Crop Insurance Corporation program. Since Centre County farms are eligible for crop insurance, it is possible to determine agricultural losses due to drought in the County. Table 4.3.1-3 displays the crop loss insurance payments by year due to drought (including even mild drought occurrences) from 2005 through 2020. Please note that data was unavailable for crop years 2015 and 2016. Based on these indemnity payment amount, crop losses in 2011 were the highest followed by 2018.

Table 4.3.1-3: Crop Loss Insurance Compensation Due to Drought (USDA, 2020)

CROP YEAR	INDEMNITY AMOUNT
2005	$223,228
2006	$24,164
2007	$156,093
2008	$97,009
2009	$0.00
2010	$40,837
2011	$769,958
2012	$100,157
2013	$102,311
2014	$102,311
2015	N/A
2016	N/A
2017	$211,070
2018	$617,499
2019	$466,966
2020 (Year-to-Date)	$508,991

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 4.3.1-2, Centre County has experienced between 31-35 years with recorded droughts as of 2014. A drought year is defined by at least one summer month with a moderate to extreme drought. As shown on the map, central Pennsylvania, including Centre County, experienced more drought years than the rest of the Commonwealth. This is the best data available at the time of this Plan Update.

Figure 4.3.1-2: PSDI for Centre County, 2014



4.3.1.4 Future Occurrence

It is difficult to forecast the severity and frequency of future drought events in Centre County. Central Pennsylvania has averaged 3.4 dry periods (defined as ten or more consecutive days having less than 0.01 inch of precipitation) per year from 1950 through 1992. Based on data from 1895 to 1995, Centre County has an annual probability of severe or extreme drought of 10-15% (see Figure 4.3.3-1). This is equivalent to a PDSI value less than or equal to -3. Therefore, the probability of drought impacting Centre County is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

Overall, the County feels that current water needs are being met even during times of drought. However, 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 region around State College is projected to experience an increase in heatwaves by 2050, in addition to warmer conditions doubling in intensity in this time frame according to Climate Central. Climate Central also projects the region will experience droughts more than two times the current amount by 2050 (Climate Central, 2019). With these projections, it is anticipated that the region could become more vulnerable to drought events.

4.3.1.5 Vulnerability Assessment

In 1990, the PA DEP had predicted water yield deficiencies for ten county public water supplies. DEP further predicted that Centre County would experience yield deficiencies equal to or greater than the other four counties in the Central West Branch Susquehanna River Sub-basin combined. These have not yet manifested themselves to a significant degree. Centre County, however, is a headwaters location for numerous small watercourses, and therefore communities which rely on surface water can experience the direct impacts to the streams on which they rely. Headwater communities' water supply becomes more vulnerable when stream flows have been reduced by out-of-basin diversions and when there are reductions in stream flow due to low precipitation. Water quality issues, associated with low rainfall periods and the need to meet demand through lower quality water sources, are an ongoing concern with several water service areas. There are 44 public water suppliers recognized within Centre County, which obtain water from surface water and wells. Smaller systems typically use wells and have undersized storage facilities that are incapable of providing adequate operating, emergency and fire reserves. Communities with other water-dependent industries and recreation areas are vulnerable as well. A map of all water service areas within Centre County is included in Figure 4.3.1-3.

Centre County residents that use private domestic wells are more vulnerable to droughts because their drinking water can dry up. Table 4.3.1-4 shows the number of domestic wells per municipality. In 2020, the total number of domestic wells in Centre County is 2,080. Areas most vulnerable to drought due to high numbers of domestic wells are primarily found in the County's townships, with Potter, Benner, Ferguson, and Patton Townships with the highest number of total wells. Domestic well data was obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS relies on voluntary submissions of well record data by well drillers

and is therefore 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: PaGWIS Domestic Water Wells Drilled per Municipality (PAGWIS, 2020)

MUNICIPALITY	NUMBER OF REPORTED DOMESTIC WELLS
Bellefonte Borough	7
Benner Township	114
Boggs Township	104
Burnside Township	2
Centre Hall Borough	5
College Township	60
Curtin Township	47
Ferguson Township	119
Gregg Township	142
Haines Township	66
Halfmoon Township	50
Harris Township	65
Howard Borough	1
Howard Township	36
Huston Township	66
Liberty Township	88
Marion Township	74
Miles Township	61
Milesburg Borough	1
Millheim Borough	7
Patton Township	97
Penn Township	75
Philipsburg Borough	0
Port Matilda Borough	0
Potter Township	232
Rush Township	57
Snow Shoe Borough	1
Snow Shoe Township	41
Spring Township	77
State College Borough	7
Taylor Township	44
Union Township	46
Unionville Borough	1
Walker Township	55
Worth Township	70
Unknown	162
Total	2,080

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 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, 2020a). 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 Centre County will be more susceptible to risks from drought, as will public and private water supplies.

Centre County's agricultural production totals $91.5 million. Roughly 30 percent of this total is the production of crops, including nursery and greenhouse crops ($31.4 million); the remaining agricultural production is made up of livestock, poultry, and their products (USDA, 2017). The county also has significant sales in grains, oilseeds, dry beans, and dry peas ($21.9 million). Table 4.3.1-5 lists the top livestock inventory items in Centre County. With these agricultural assets, drought events can severely impair the local economy with prolonged drought negatively impacting the livelihood of residents within agricultural communities particularly.

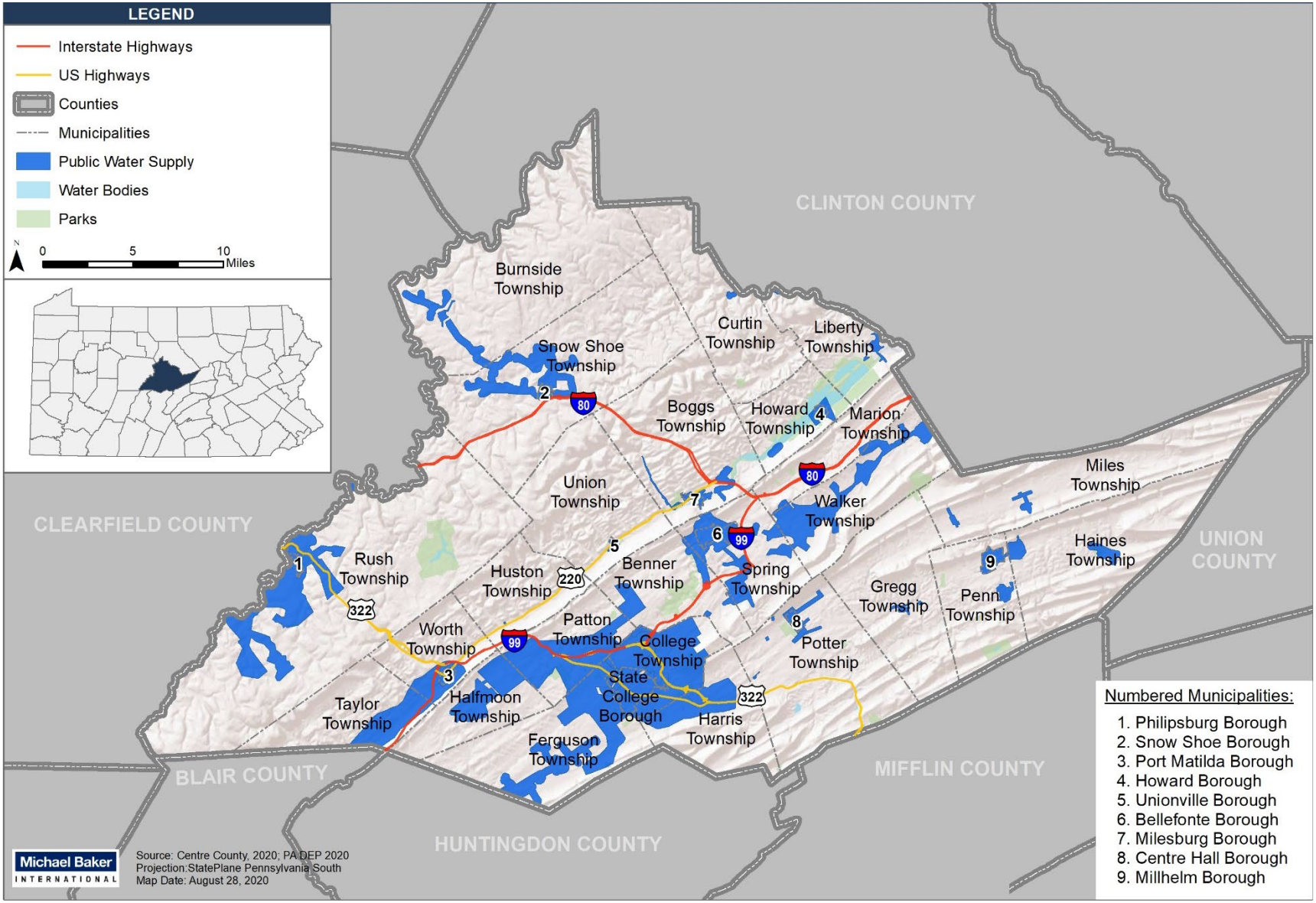
Table 4.3.1-5: Top Livestock Inventory Items in Centre County (USDA, 2017)

LIVESTOCK	INVENTORY
Cattles and Calves	28,075
Hogs and Pigs	2,510
Sheep and Lambs	2,133
Layers (Chickens)	4,950

As of the 2017 USDA's Census of Agriculture, Centre County ranks 24th out of the 67 Commonwealth counties in total market value of agricultural products sold. The production value of agricultural products in Centre County was estimated as $91,478,000, which is approximately the same value as the last agricultural census conducted in 2012 (USDA, 2017). In addition, Centre County is estimated to have 1,023 farms on 149,858 acres, with an average size of 146 acres per farm. The agriculture industry has a significant presence in the central and eastern portion of the County with products including dairy, meats, fruits, and vegetables.

Therefore, drought events can severely impair the local economy with prolonged drought negatively impacting the livelihood of residents within agricultural communities particularly. The Penn State University College of Agricultural Sciences is a valuable resource in reducing drought vulnerability, through education and other services they provide not only to area farmers, but to the general public through water conservation education.

Figure 4.3.1-3: Public Water Supply in Centre County, 2020



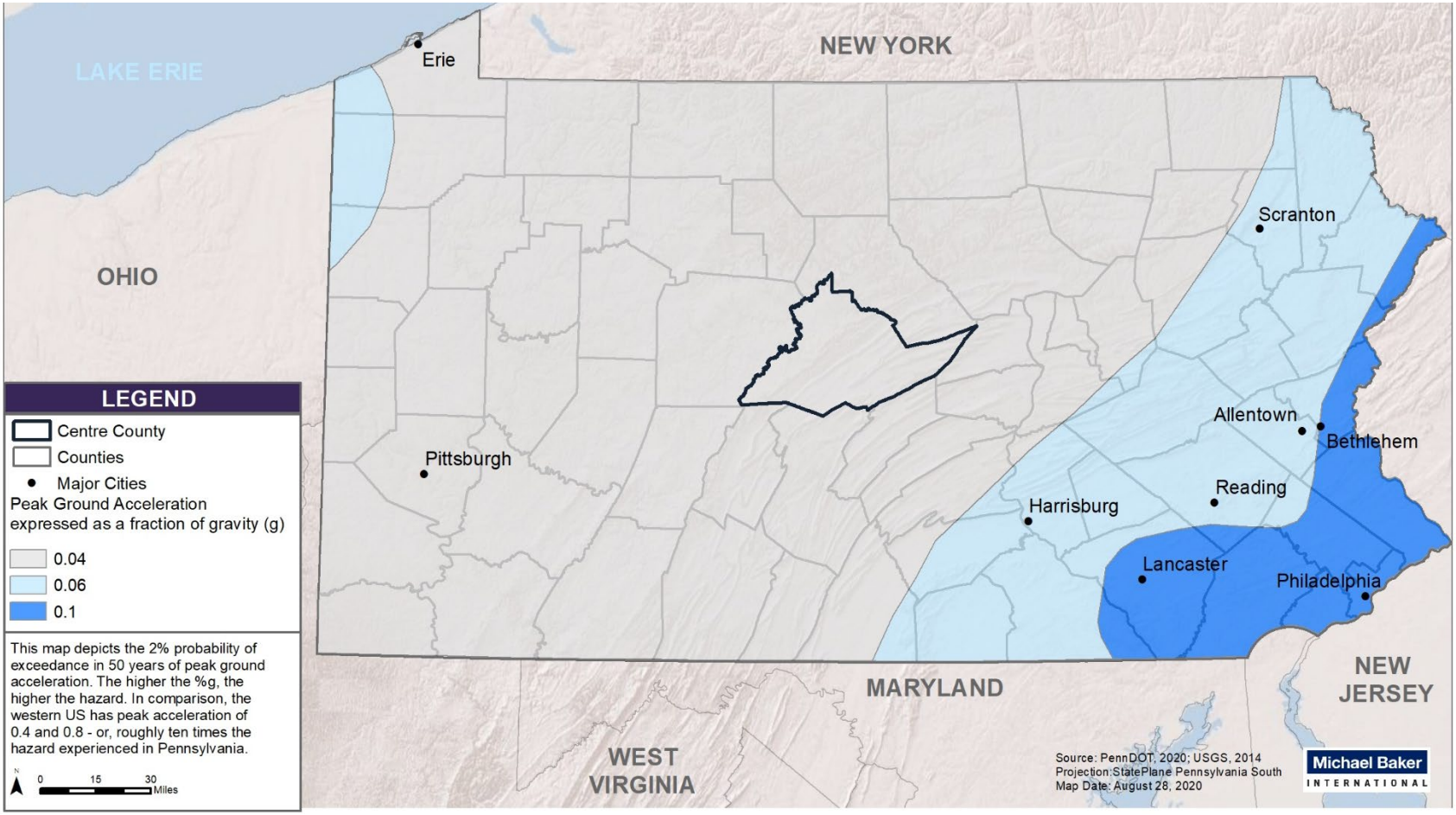
4.3.2 Earthquakes

4.3.2.1 Location and Extent

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. They can also result from human activity like mine blasts and nuclear experiments. The closest fault line that might contribute to an earthquake in Centre County is the Mid-Atlantic Ridge, which is approximately 2,000 miles to the east of Pennsylvania. As regional hazards, an earthquake would affect all of Centre County. Earthquakes can cause damage to buildings and other rigid superstructures, depending on factors like earthquake magnitude, distance of local areas to the earthquake epicenter, and local geologic conditions. It remains incredibly difficult to predict when and where an earthquake will occur in the northeast United States. and Pennsylvania.

Earthquake events in Pennsylvania typically do not impact areas greater than 100 km (62 miles) from the epicenter, and earthquake epicenters in Centre County are rare. The area is generally not known for seismicity, and USGS downgraded the probabilistic seismic hazard for much of Pennsylvania in 2014. Figure 4.3.2-1 shows the earthquake hazard in Pennsylvania and Centre County, expressed as the two-percent probability of exceedance in 50 years of peak ground acceleration (g). The following map was digitized from the National Seismic Hazard report. Centre County lies in the 0.04 zone, indicating that the hazard is slight to moderate. However, earthquakes originating outside of Pennsylvania can affect Centre County, though they are not expected to cause significant damage. This was the most current data available when updating this plan.

Figure 4.3.2-1: Approximate USGS Seismic Hazard for Pennsylvania, 2014



4.3.2.2 Range of Magnitude

There are several different ways of describing the magnitude of an earthquake. One method measures peak ground acceleration. Peak ground acceleration is the maximum horizontal ground acceleration measured in centimeters per second per second (cm/sec$_2$). Peak ground acceleration can range from zero for an earthquake that is noticed by very few people to 350, which would be categorized as a catastrophic event. A peak ground acceleration of 10 cm/sec$_2$ means that the shaking is equivalent to about one percent of the acceleration due to gravity. Generally, ground acceleration must exceed 15 cm/sec$_2$ for significant damage to occur.

Earthquake magnitude is often measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. Table 4.3.2-1 below summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. Pennsylvania has not experienced any earthquakes with a magnitude greater than 6.0.

Table 4.3.2-1: Richter Scale Magnitudes and Associated Earthquake Size Effects

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive up to about 100 kilometers from epicenter.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

The Richter Scale does not give any indication of the impact or damage of an earthquake, although it can be inferred that higher magnitude events cause more damage. Therefore, another way of measuring the intensity of an earthquake is the Modified Mercalli Intensity Scale. Measures on this scale range from I, an earthquake that is not generally noticeable, to XII, an earthquake that causes complete destruction. The table below summarizes Modified Mercalli Intensity Scale impacts of earthquake events, measured in terms of earthquake intensity.

Table 4.3.2-2: Modified Mercalli Intensity Scale with Associated Impacts

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	Instrumental	Usually detected only on seismographs.	<4.2
II	Feeble	Some people feel it	
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	

Table 4.3.2-2: Modified Mercalli Intensity Scale with Associated Impacts

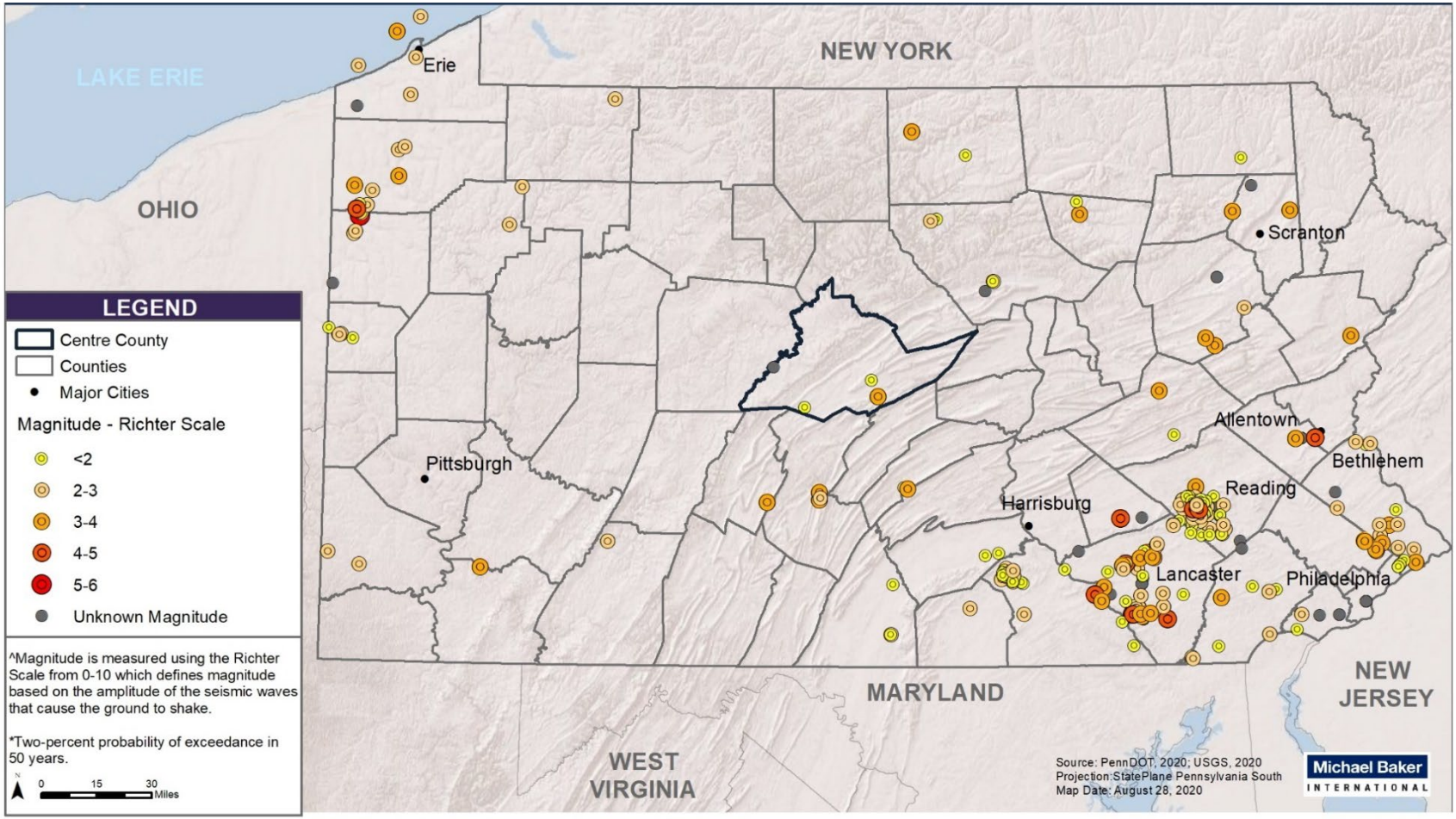
SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<5.4
VII	Very Strong	Mild alarm, walls crack, plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	>8.1

Recent earthquakes in Pennsylvania have been measured from IV to VI on the Modified Mercalli Intensity Scale. However, since the worst earthquake recorded in Pennsylvania was a magnitude 5.2, a worst-case scenario for this hazard would be if an earthquake of similar magnitude occurred in or around Centre County near a populated area. Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts like economic impacts are considered. Earthquakes are known for causing induced tsunamis, flooding, landslides, and avalanches; poor water quality; damage to vegetation; and breakage in sewage or toxic material containments. However, because of its geographic location, these impacts are extremely unlikely to occur in Centre County.

4.3.2.3 Past Occurrence

According to records maintained by DCNR, there have been four earthquakes recorded with epicenters in Centre County. A light earthquake was recorded in Centre County on August 15, 1991, measuring 3.0 on the Richter scale. This earthquake occurred about 10 miles east of State College, and authorities reported no damage. Only three other earthquake epicenters have been measured in Centre County. However, parts of the County have likely experienced shock waves from some minor earthquakes that have occurred around the region shown on Figure 4.3.2-2. For example, 10 occurrences of loud bangs and tremors were reported to the Centre County OES in October 2018. These occurred around the eastern side of Bellefonte Borough. In May 2019, tremors were again reported to the County from an earthquake in nearby Juniata County. The earthquake measured 3.4 on the Richter scale, however there were no reports of damage in Centre County.

Figure 4.3.2-2: Map of Earthquake Epicenters in Centre County, 2020



4.3.2.4 Future Occurrence

The probability of an earthquake event occurring in Centre County is very low. Centre County does not sit on any fault lines; therefore, it is reasonable to believe that the County will not experience earthquake damage anytime soon. The future occurrence of earthquakes can be considered *unlikely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.2.5 Vulnerability Assessment

All structures and infrastructure in Centre County are equally at risk of experiencing an earthquake. However, in a mild earthquake of the magnitude typically experienced in Pennsylvania, no structural damage is anticipated. In other cases, damages are expected to be limited, and examples of anticipated damages are broken dishes and windows and toppled file cabinets.

However, for earthquakes, the available history covers a period of less than 300 years, which is a relatively short period of time for an examination of earthquakes. Large earthquakes may only affect a location every several centuries or millennia. Environmental impacts of earthquakes can be numerous, widespread and devastating, particularly if indirect impacts are considered. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failure. These secondary events could also result in disruptions to natural ecosystems, poor water quality, damage to vegetation, and the release of toxic materials and sewage. Impacts to infrastructure could include train derailments, pipeline failures, and utility interruptions. A very large earthquake affecting Centre County might cause structural damage in dilapidated structures or structures that do not meet current building codes. Thus, the impact of an earthquake might range from negligible to catastrophic. Based on historical data for Centre County, damage is likely to be minimal.

Structures identified as potentially at risk of damage due to an earthquake are older structures. All existing buildings have the potential to experience an earthquake. Given no history of damage in Centre County due to earthquake, damages are estimated to be limited to the more dilapidated structures and structures with unreinforced masonry. The number of structures that are at least 50 years old in Centre County is 8,632 (U.S. Census Bureau, 2018).

All future structures will also have the potential to experience an earthquake. However, given that new structures must meet current building codes and given the expected magnitude of earthquakes in the County, no property damages are anticipated.

4.3.3 Extreme Temperature

Extreme temperature includes both hot and cold temperatures. Extreme cold temperatures drop well below what is considered normal for an area during the winter months and often accompany winter storm events. Combined with increases in wind speed, such temperatures in Pennsylvania can be life threatening to those exposed for extended periods of time. Extreme heat can be described as temperatures that are above the average high temperature for a region during the summer months.

4.3.3.1 Location and Extent

All of Centre County may be subject to extreme temperatures in the summer and winter seasons. Areas most susceptible to extreme heat include urban environments, as buildings and pavement absorb and retain heat, causing an Urban Heat Island Effect. Areas most susceptible to extreme cold include higher elevations. Different populations and industries may experience extreme temperatures differently. Demographics must also be considered, as large populations of elderly or poor represent those most vulnerable to temperature extremes.

Figure 4.3.3-1 and Figure 4.3.3-2 show annual mean maximum and minimum temperatures throughout Pennsylvania and highlight Centre County. These maps present the year-round average minimum temperature (41.3°F) and average maximum temperature (59.2°F). Elevation and topography account for local differences seen on the maps. However, during the summer, the average high temperature is 79.9°F and the average low is 60.8°F in Centre County. In winter, the average high in Centre County is 36.6°F and the average low is 22.3°F (NOAA-NCEI, 2020b). This remains the best available data in 2020.

Figure 4.3.3-1: Average Minimum Temperature in Centre County, 2012

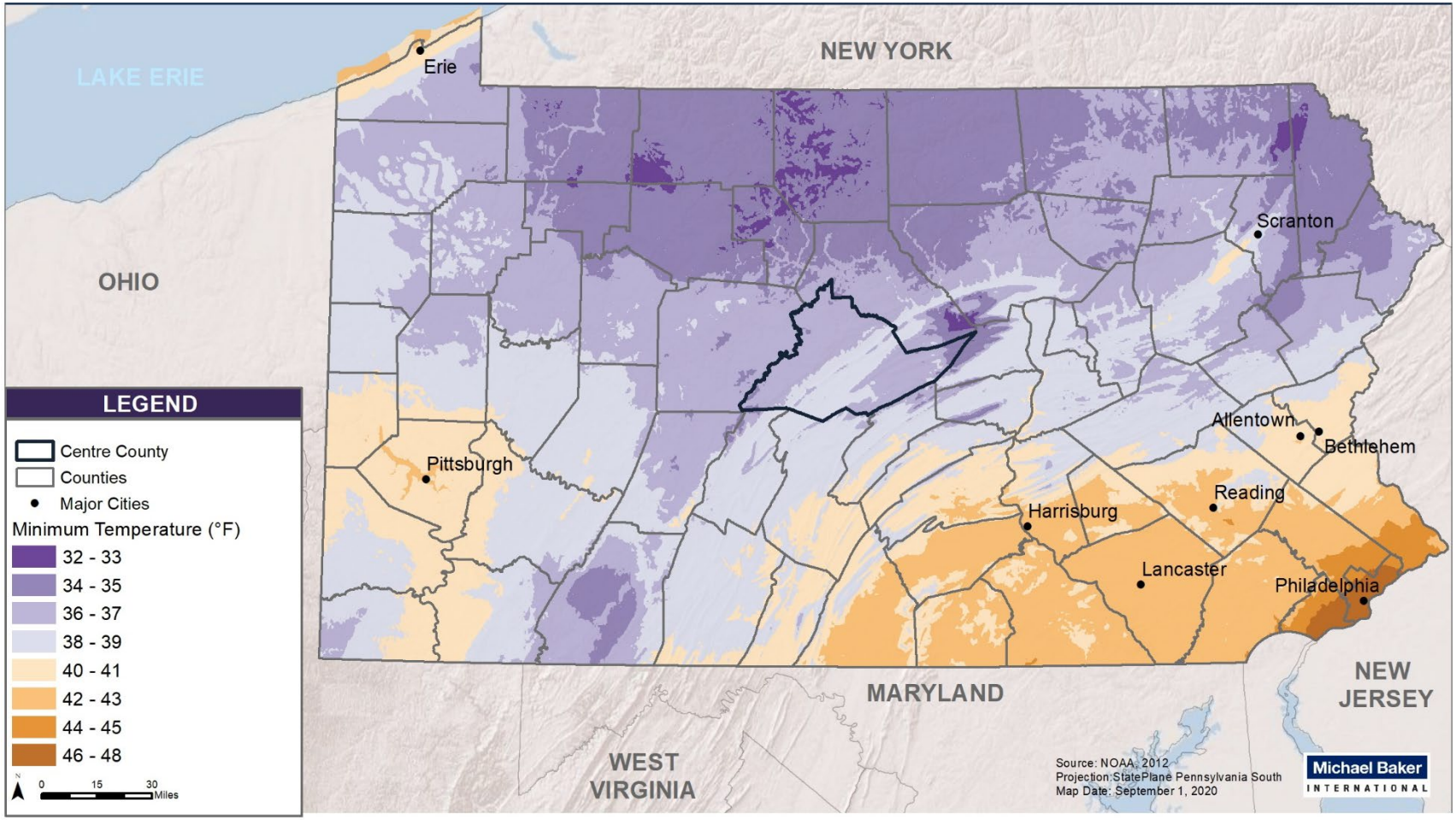
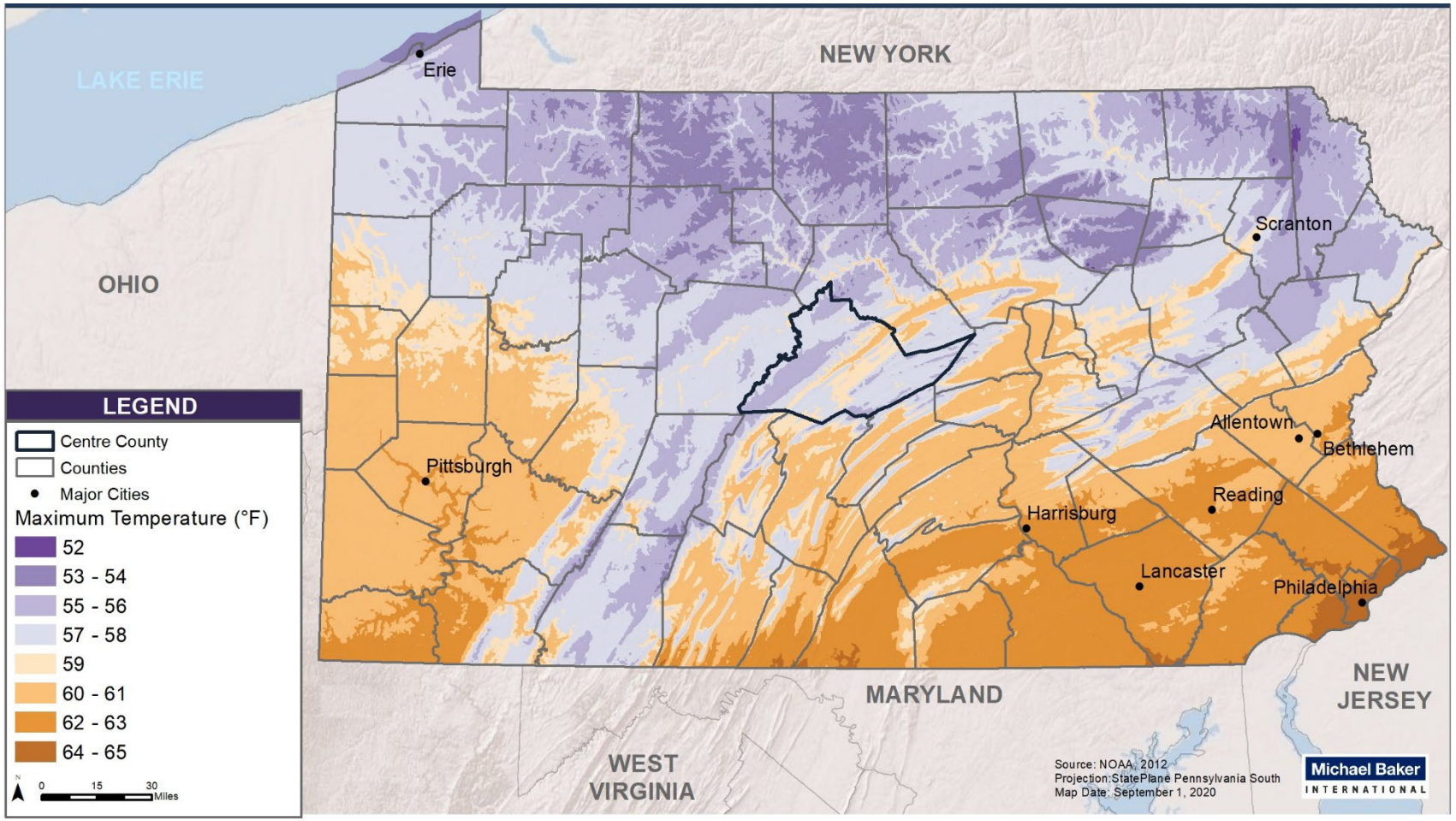


Figure 4.3.3-2: Average Maximum Temperature in Centre County, 2012



4.3.3.2 Range of Magnitude

Extreme temperatures can be disruptive and/or dangerous, especially for the elderly, disabled, poor, and otherwise disadvantaged members of communities. Extreme heat and cold can also impact transportation, agriculture, and energy supplies.

The following impacts can be observed in conjunction with extreme temperature events:

- Health Impacts: Both extreme cold and extreme heat can cause severe health impacts. The impacts of severe cold include hypothermia and frostbite from prolonged exposure. Cold weather also raises the risk of injuries from falls, traffic incidents, carbon monoxide poisoning, and house fires. Health impacts of extreme heat include heat stroke and dehydration. The health impacts of extreme cold are greater in terms of mortality in humans, but often after more prolonged exposure vs. a cold snap. Extreme heat waves, however, can prove more deadly over a shorter duration. Both extreme heat and extreme cold are most likely to impact the elderly, low income individuals, residents with disabilities and pre-existing medical conditions, and laborers and farm workers.
- Transportation: Cold weather can impact automotive engines, possibly stranding motorists; limit or prevent travel by pedestrians, bicyclists, and users of public transportation; and stress metal bridge structures. Highways and railroad tracks can become distorted in high heat. Disruptions to the transportation network and accidents due to extreme temperatures represent an additional risk.
- Agriculture: Absolute temperature and duration of extreme cold can have devastating effects on trees and winter crops. Livestock is especially vulnerable to heat. Crop yields can be impacted by heat waves or cold snaps that occur during key development stages, even at levels that do not impact most of the population.
- Energy: Energy consumption rises significantly during extreme cold weather, and any fuel shortages or utility failures that prevent the heating of a dwelling place residents in extreme danger. Extreme heat also can result in utility interruptions, and sagging transmission lines due to the heat can lead to shorting out.

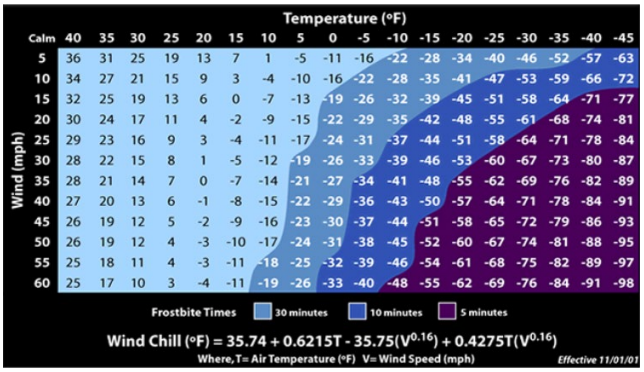
The range of these impacts, especially health effects, can be mitigated through improved forecasts, warnings, community preparedness, and appropriate community response. A worst-case event for Centre County would include extreme cold temperatures combined with an interruption in energy supplies and loss of access to medical care from snow or ice impacting travel. Medical afflictions could result from direct influence on the coronary circulation system and the respiratory system; influenza and other infectious diseases would be secondary impacts.

The experience of extreme heat and extreme cold varies considerably depending on humidity and wind conditions, respectively. Figure 4.3.3-3 shows the effects of wind speed on extreme cold events and humidity on extreme heat events. These compounding factors can increase the risk experienced by vulnerable populations and the general public. While the temperatures in Figure 4.3.3-3 serves as a guide for various danger categories, the impacts of high temperatures will vary from person to person based on individual age, health, and other factors.

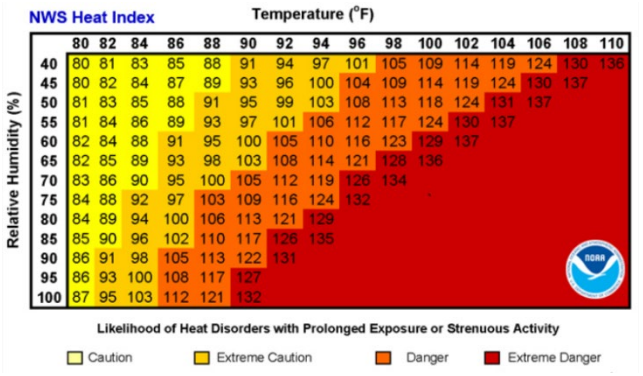
NWS issues temperature advisories, watches, and warnings. Exact thresholds vary across the Commonwealth, but in general heat advisories are issued when the heat index will be equal to or greater than 100°F, but less than 105°F, excessive heat warnings are issued when heat indices will attain or exceed 105°F, and excessive heat watches are issued when there is a possibility that excessive heat warning criteria may be experienced within twelve to forty-eight hours. Similarly, NWS issues wind chill warnings, watches, and advisories. A wind chill warning is issued when extremely cold wind chill values are occurring; a watch when extremely cold wind chill values are possible; and an advisory when seasonably cold wind chill values are occurring (NOAA NWS, 2020a).

Figure 4.3.3-3: Effects of Wind Speed on Extreme Cold Events (Wind Chill) and Humidity on Extreme Heat Events (Heat Index) (NOAA, 2020b) (NOAA, 2020c)

Extreme Cold and Wind Chill



Extreme Heat and Heat Index



Major human risks to extremely high temperatures include heat cramps, heat syncope, heat exhaustion, heatstroke, and death. The elderly, the very young, and those with low or no income are most vulnerable to health-related impacts of extreme temperatures. Cold temperatures can be extremely dangerous to humans and animals exposed to the elements. Without heat and shelter, cold temperatures can cause hypothermia, frost bite, and death. Wind chill temperatures are often used in place of raw temperature values due to the effect of wind can have in drawing heat from the body under cold temperatures.

4.3.3.3 Past Occurrence

Historically, the highest and lowest recorded temperatures in central Pennsylvania, as observed by NWS in State College, PA were 102 degrees (July 17, 1988) and -20 degrees on February 10, 1898. In more recent memory, a record low -18 degrees was recorded on January 21, 1994. At this location, in the summer of 1998, four record days were set for maximum temperature in early and mid-July, ranging from 101 to 103 degrees. For record cold temperatures, the winter of 2009 set two records of -6 and -13 degrees respectively on consecutive days in January. There have been also been numerous cold weather days with extreme wind chills, as shown in Table 4.3.3-1. Since 2015, there has been one recorded extreme temperature event in the County.

Table 4.3.3-1: Previous Temperature Extremes Impacting Centre County, 2004-2020 (NOAA NCEI, 2020a)

DATE	EVENT	TEMPERATURE (HEAT INDEX AND WIND CHILL)	DEATHS	INJURIES	PROPERTY DAMAGE RECORDED	CROP DAMAGE RECORDED
12/20/2004	Cold/Wind Chill	NA	0	0	$0.00	$0.00
7/17/2006	Heat	Mid 90s° F (heat index of 96 – 101)	0	0	$0.00	$0.00
8/1/2006	Heat	Low 90s° F (heat index of 97 – 102)	0	0	$0.00	$0.00
1/26/2007	Extreme Cold/Wind Chill	-15° F (with wind chill)	0	0	$0.00	$0.00
2/3/2007	Extreme Cold/Wind Chill	-30°F (with wind chill)	0	0	$0.00	$0.00
2/5/2007	Extreme Cold/Wind Chill	-15° F (with wind chill)	0	0	$0.00	$0.00
2/16/2007	Extreme Cold/Wind Chill	-15° F (with wind chill)	0	0	$0.00	$0.00
3/6/2007	Extreme Cold/Wind Chill	-20° F (with wind chill)	0	0	$0.00	$0.00
2/10/2008	Extreme Cold/Wind Chill	-20° F (with wind chill)	0	0	$0.00	$0.00
12/21/2008	Extreme Cold/Wind Chill	-20° F (with wind chill)	0	0	$0.00	$0.00
1/15/2009	Extreme Cold/Wind Chill	-30° F (with wind chill)	0	0	$0.00	$0.00
1/16/2009	Extreme Cold/Wind Chill	-30° F (with wind chill)	0	0	$0.00	$0.00
3/2/2009	Extreme Cold/Wind Chill	-25° F (with wind chill)	0	0	$0.00	$0.00
1/6/2014	Extreme Cold/Wind Chill	-50° F (with wind chill)	0	0	$0.00	$0.00
1/28/2014	Extreme Cold/Wind Chill	-30° F (with wind chill)	0	0	$0.00	$0.00
2/15/2015	Extreme Cold/Wind Chill	-35° F (with wind chill)	0	0	$0.00	$0.00
2/19/2015	Extreme Cold/Wind Chill	-35° F (with wind chill)	0	0	$0.00	$0.00
1/30/2019	Extreme Cold/Wind Chill	-30° F (with wind chill)	0	0	$0.00	$0.00

4.3.3.4 Future Occurrence

Centre County is unlikely to face an extreme temperature event. Due to its location and geography, the County is more likely to encounter extreme cold weather than excessive heat. Topography and vegetation can impact temperature differentials across the County. Therefore, the probability of an extreme temperature event in Centre County is considered *unlikely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

According to the Fourth National Climate Assessment, which utilized the Intergovernmental Panel on Climate Change's Representative Concentration Pathways (RCP) 4.5 and 8.5 scenarios, the annual average temperature across the United States is projected to increase by 2.5°F (RCP 4.5) or 2.9°F (RCP 8.5) between 2021 and 2050, relative to 1976-2005. The RCP 4.5 scenario assumes moderate measures are taken to reduce emissions, while the 8.5 scenario assumes a lower effort and thus more severe impacts. For the Northeast region, the change in annual average temperature is 3.98°F (RCP 4.5) or 5.09°F (RCP 8.5) by 2036-2065 and 5.27°F (RCP 4.5) or 9.11°F (RCP 8.5) by 2071-2100. These changes translate to approximately 20 to 30 more days above 90°F and 20 to 30 fewer days below freezing in the northeastern parts of the United States by mid-century (RCP 8.5) (Vose et al. 2017). Climate Central also projects an increase in extreme temperature events in the Centre County region. Warming intensity is expected to double by 2050 and heatwaves are expected to increase (Climate Central, 2019).

4.3.3.5 Vulnerability Assessment

The potential for extreme heat and cold always exists in and around the summer and winter months. Meteorologists and weather forecasters can normally predict the temperature with excellent accuracy. Adhering to extreme temperature warnings can significantly reduce the risk of temperature related illness or death. Those hardest hit by both heat and cold waves include the elderly, disabled, and those who are socio-economically disadvantaged. Excessive heat exposure also affects people with certain pre-existing medical conditions, including cardiovascular disease, respiratory illnesses, and obesity. All 35 jurisdictions are considered vulnerable to the effects of extreme temperatures, but these vulnerabilities can vary across the general population. Efforts to mitigate the impacts should focus on those groups most vulnerable.

4.3.4 Flood, Flash Flood, Ice Jam

4.3.4.1 Location and Extent

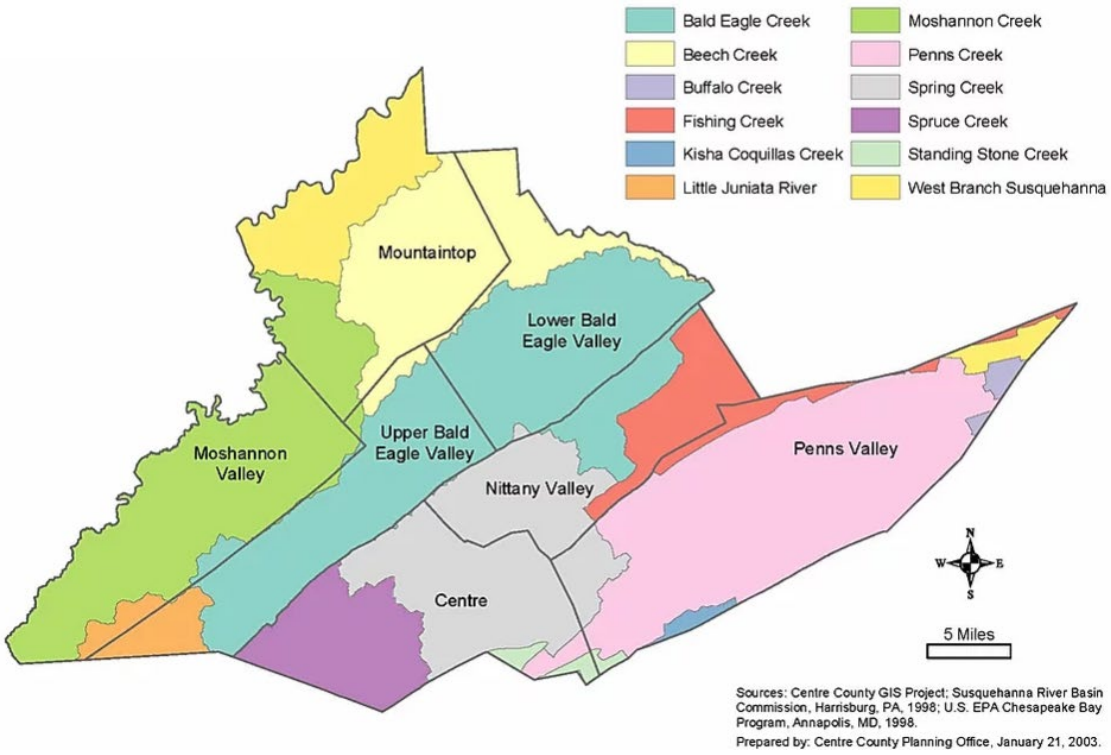
Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all natural hazards in Pennsylvania. Flooding occurs when excess water from snowmelt or rainfall fills a stream, causing it to overflow onto the stream banks and adjacent 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.

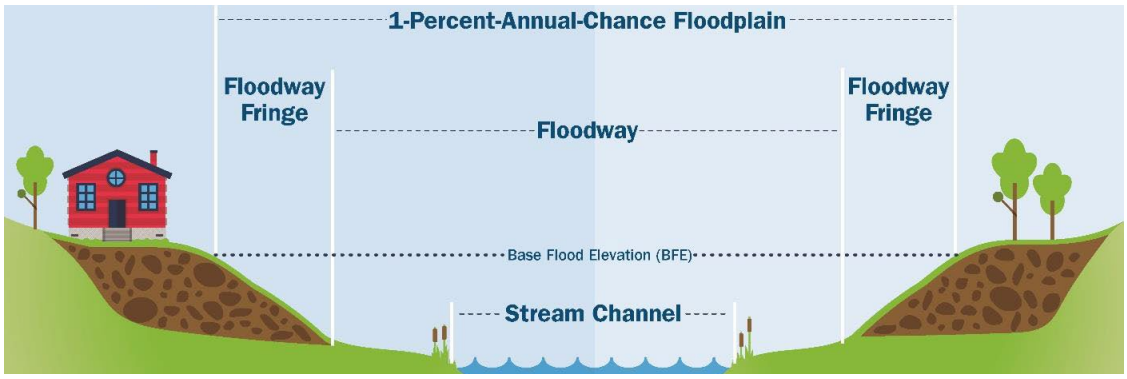
Centre County lies in the Susquehanna River Basin, one of the most flood prone river basins in the nation. The Susquehanna River Basin encompasses almost half the State and continues into Maryland where the River drains into the Chesapeake Bay. Waterways throughout the County flow into the Susquehanna River, although the river does not flow through Centre County itself (PACD, 2020). The County can be further broken down into minor watersheds around local waterways. Figure 4.3.4-1 illustrates these watersheds with an overlay of the Centre County Planning Districts. Spring Creek Watershed has been identified as a focus area for watershed maintenance due to expected growth in population and development. While this local watershed only covers about 13 percent of the County's total land area, it accounts for about 71 percent of the County's total population (Spring Creek Watershed Commission, 2017).

Figure 4.3.4-1: Centre County Susquehanna River Basin Watersheds and Planning Districts (Spring Creek Watershed Commission, 2017)



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 4.3.3.4. However, in assessing the potential spatial extent of flooding it is important to know that a floodplain associated with 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 to identify Base Flood Elevations (BFE), terms identified in Figure 4.3.3-2. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth, and the County when determining flood risk.

Figure 4.3.4-2: Diagram Identifying the Special Flood Hazard Area, Floodway and Flood Fringe



The effective FIRM was published for Centre County on January 16, 2015 and May 4, 2009. An example of the mapping products published is shown in Figure 4.3.4-3, which illustrates flood hazard areas along Spring Creek in Bellefonte, Benner, and Spring Townships. The current Flood Insurance Study (FIS) report was published for Centre County on January 16, 2015 (FEMA, 2015). 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) and can be used to identify the expected spatial extent and elevation of flooding from a 1-percent- and 0.2-percent-annual-chance flood event. All but one municipality (Centre Hall Borough) in the County has identified SFHAs (FEMA, 2015).

Figure 4.3.4-3: FIRM Panel 42027C0368G, January 16, 2015
(shows flood hazard areas along Spring Creek in Bellefonte, Benner, and Spring Townships)

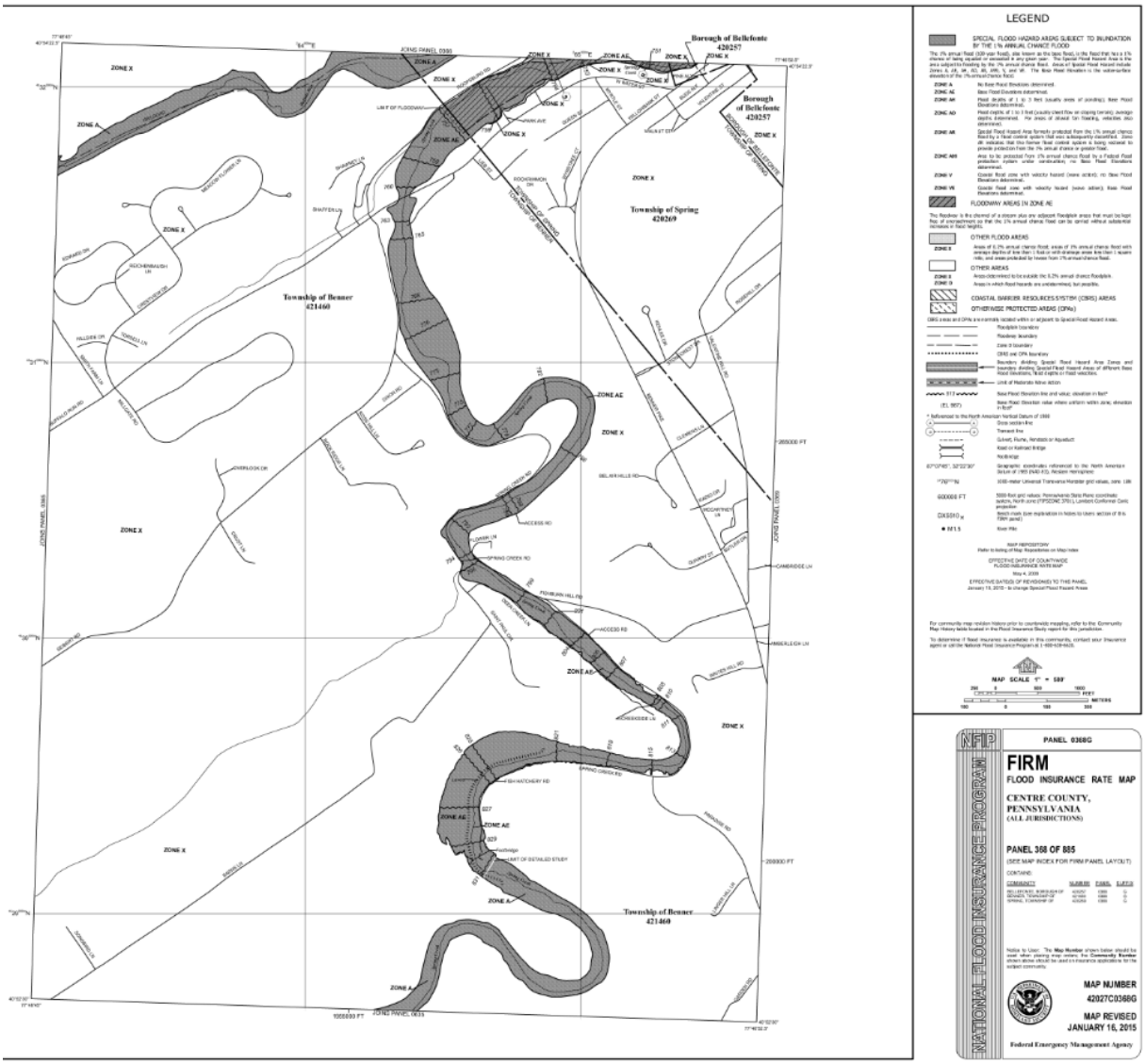
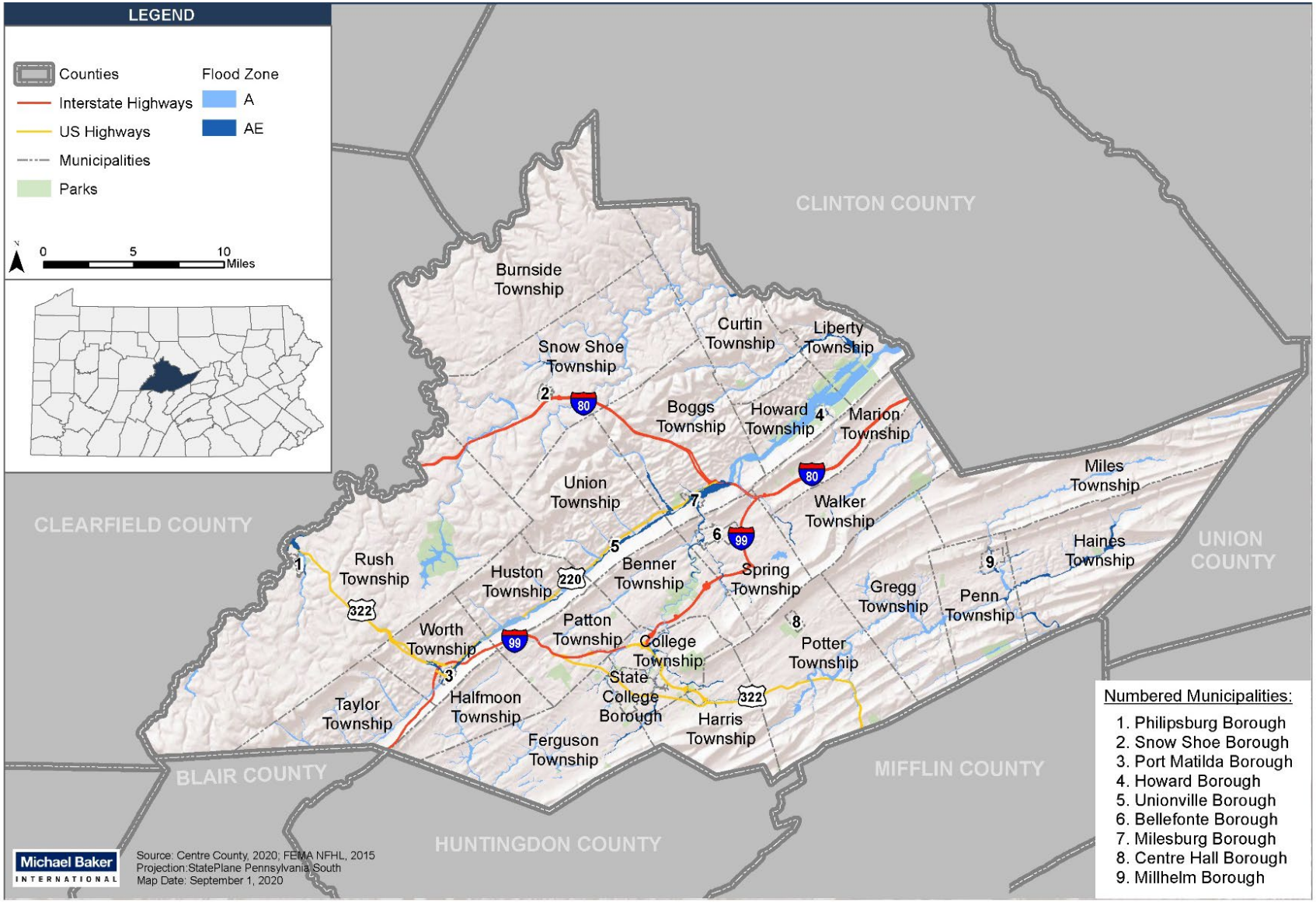


Figure 4.3.4-4 shows the location of approximate and detailed (includes BFEs) SFHAs in Centre County.

Figure 4.3.4-4: Special Flood Hazard Area in Centre County



The countywide FIS conducted by FEMA identifies areas of principal flood problems (FEMA, 2015). Spring Creek causes the majority of flooding within the county, impacting the municipalities of Bellefonte, Milesburg, Spring, and others. Milesburg Borough experiences flood issues as it is located at the confluence of Spring Creek with Bald Eagle Creek. Additionally, a power generator in Milesburg is located in the 1-percent-annual-chance floodplain and is subject to flood inundation. Bridge obstruction during heavy rain and runoff on Moshannon Creek has resulted in flooding in the Philipsburg Area. Further, street flooding and sewage system backups occur in Philipsburg Borough and Rush Township when heavy rains overwhelm the storm water systems. Phantom Lake, located on both sides of State Route 64 near Pleasant Gap, is an unpredictable hydrologic phenomenon that appears and disappears quickly based on weather patterns. The Lake can occasionally cause problems for motorists along nearby roadways.

Major storms can cause localized inundation of structures along streams and creeks across the County including: Bald Eagle Creek, Beech Creek, Beaver Branch, Big Hollow Run, Black Moshannon Creek, Cedar Run No. 2, Cherry Run, Cold Stream, Council Run, Dewitt Run, Elk Creek, Galbraith Gap Run, Halfmoon Creek, Laurel Run, Lick Run, Little Fishing Creek, Little Marsh Creek, Little Sandy Run, Marsh Creek, Moose Run, Moshannon Creek, Nittany Creek, North Fork Beech Creek, Oliver Run, Penns Creek, Pine Creek, Piney Run, Roaring Run, Slab Cabin Run, South Fork Beech Creek, Spring Creek, Spruce Creek, Thompson Run, Wallace Run, Walnut Run, and Wolf Run.

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 G, Centre County has 10 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 six levee systems in Centre County through the National Levee Database (USACE, 2020).

4.3.4.2 Range of Magnitude

Flooding in Centre 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 Centre 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 4.3.5, the County occasionally experiences intense rainfall from tropical storms in late summer and early fall.

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, paved roadways, or other impervious developed areas.

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 or no vegetative ground cover. Centre County has sloping terrain near prominent ridges and in the western highlands, which can contribute to more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain. Flooding can also be exacerbated through the process of urbanization. Increased development of impermeable surfaces in buildings and pavement or a lack of appropriately sized flood water detention basins leads to localized flooding.

The most severe flooding in Central Pennsylvania has been associated with the Susquehanna River Basin, which drains directly into the Chesapeake Bay and is the largest river basin on the Atlantic Coast. The greatest magnitude of countywide flooding impacts were reported as a result of Hurricane Agnes in 1972. During June 20-26, Hurricane Agnes dumped 9.64 inches of rain on Centre County, triggering record-setting, widespread flooding. In terms of localized property damage, the costliest flood event occurred in June 2013 as a result of flash flooding in the Centre Region from Pine Grove Mills in Ferguson Township through State College and in Bellefonte and Milesburg Boroughs. According to NOAA's NCEI, intense rains in the area resulted in $1.5 million worth of damage in Centre County. The area experienced numerous road closings including portions of Routes 26, 3005, 45, and 550 with the area along Route 150 from Milesburg to Blanchard/Beech Creek near the Centre/Clinton county line being hardest hit. The Bald Eagle Creek at Beech Creek Station surged close to eight feet in four hours. A flood event of this magnitude can be considered a worst-case scenario for Centre County. Further details about this event and other significant flood events are found in Section 4.3.4.3.

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 of crops, and drowning of both humans and animals.

Dams, levees, and reservoirs act as flood protection measures. There are 48 dams in the County; however, 10 of these are high hazard dams. Please refer to the Dam Failure hazard profile in Appendix G for more information on dams. As previously mentioned, there are six levee systems in the County.

In addition to flood protections from dams and levees, protection measures have been built up through various regulations and physical projects across the County. A portion of the channel along Moshannon Creek has been straightened and minor channel improvements have been made along Bald Eagle Creek. Spring Township has an inundation ditch that diverts runoff from the southern portion of Pleasant Gap. It is approximately two feet deep and 10 feet wide. Additionally, local land use regulations adopted from the code of Federal Regulations, Title 24, Chapter 10, FIA, Parts 1910.3A and 1910.3B control building within areas that have high flood risk (FEMA, 2015).

4.3.4.3 Past Occurrence

Centre County has a long history of flooding events. Small localized flooding events occur annually with minimal property damage. A total 11 of the 15 Presidential Disaster and Emergency Declarations affecting Centre County have been in response to flood hazard events (see Table 4.2-1). Flooding events, including those associated with Disaster Declarations, are listed in Table 4.3.4-2. From the table, the January 1996 flood is highlighted as representative of the usual type of damage that can occur within the County from a severe flood event. On January 12, 1996, unseasonably warm weather and heavy rains melted a 28" snowpack, causing extensive severe flooding throughout the County. Homes, businesses, roads, and bridges scattered throughout the County were damaged. The entire County came to a standstill during this period, causing Governor Ridge to declare a state of emergency and close all roads. This allowed road crews to work without the interruption of vehicular traffic and provided some reimbursements of municipal expenditures for infrastructure repairs.

Historically, the most devastating flood to hit Centre County resulted from Hurricane Agnes in 1972. During June 20-26, Hurricane Agnes dumped 9.64 inches of rain on Centre County, triggering record-setting, widespread flooding. While basements flooded, and roadways and bridges were lost or damaged in every county municipality, several communities suffered greater losses than the others. Specific damages include the following:

- More than 30 families were evacuated from Milesburg, where the West Penn Power Plant (now defunct) also flooded, causing widespread power outages over large areas
- Homes on South Main Street and Harrison Road in Pleasant Gap were evacuated when it was feared Noll Dam would burst
- 35 families were evacuated from the Woodsdale Mobile Home Park in State College
- The Millbrook area was under water
- Beech Creek overflowed, isolating people in Orviston and Monument
- Millheim was evacuated
- About 75 Philipsburg families were forced from their homes and at least one business was severely damaged
- Spring Creek spilled onto Water Street closing downtown Bellefonte and damaging several businesses along Potter and Water streets
- A new playground was swept way in Port Matilda
- Water rose above the causeway into Howard and overflowed the spillway of Sayers Dam

- The Millheim Narrows disappeared under Pine Creek
- Homes, businesses, and infrastructure were also damaged or lost in Houserville, Lemont, Julian, Pine Grove Mills, Howard, Axemann, Centre Hall, Boalsburg, Madisonburg, Aaronsburg, Woodward, Rebersburg, Spring Mills, and Bush Addition

Pennsylvania State Police reported that almost all roadways in or out of the County closed. Even areas not near streams disappeared under storm runoff. At the end of the first week, County Commissioners estimated damages to businesses, homes, and public property, such as schools, municipal buildings, highways, and bridges, at $7.6 million, saying that number would go much higher as additional damages were discovered. Additionally, Penn State Cooperative Extension agents estimated that 40-50 percent of the hay crop, 30-40 percent of the small grain crop and 15 percent of the corn crop was lost. Prolonged cool temperatures and excess moisture impaired the quality of crops not listed as lost, resulting in further losses from a reduced market value.

The county also experienced severe flooding in October 2016. Intense rainfall caused flash floods across region. Infrastructure damages on roadways, bridges, and culverts were assessed around $2 million. Over 20 swift water rescue teams were employed across the county.

Other flood and flash flood events have impacted Centre County to a lesser extent. Heavy rain caused flooding and a number of road closures throughout Centre County in March 2008. Roads were closed in the towns of Coburn and Milesburg, along with more roads in Boggs, College, Liberty, Penn, and Gregg Townships. As shown in Figures 4.3.4-5 and 4.3.4-6, Spring Creek Road in Bellefonte and Spring Creek Park in College Township experienced flooded during this heavy rain event. Countywide flooding in September 2011 and flash flooding on June 2014, June 2017, and August 2018 had similar impacts. The 2011 and 2014 events are shown in Figures 4.3.4-7 and 4.3.4-8.

Figure 4.3.4-5: Flooding on Spring Creek Road in Bellefonte During Heavy Rain, March 5, 2008 (Accuweather, 2008a)

Figure 4.3.4-6: Flooding in Spring Creek Park, College Township, March 5, 2008 (Accuweather, 2008b)

Figure 4.3.4-7: Flooding along Fox Hollow Road in Patton Township, September 7, 2011 (Statecollege.com, 2011)

Flood events, including those associated with Disaster Declarations, are listed in Table 4.3.4-1. Other information on previous flood events and historical losses can be found in Section 2.3 of the Centre County FIS. The NCEI data does not include an estimate of property damage for the effects of Hurricane Lee, which Centre County received an Emergency Disaster Declaration for; according to FEMA Public Assistance records, 40 counties, including Centre, received over $495,000 in emergency work reimbursements due to the flooding from this storm.

Figure 4.3.4-8: Flooding in Boalsburg in June 2014 Pushed Rocks onto Linden Hall Road (Bauer, 2014)

Table 4.3.4-1: Flood, Flash Flood, and Heavy Rain Events Impacting Centre County from 1993-2020 (NCEI NOAA, 2020a).

DATE	LOCATION & DESCRIPTION	EST. PROPERTY DAMAGE ($)
3/30/1993	Philipsburg. The retaining boards of the Cold Stream Recreation Dam gave way, impacting three homes in Philipsburg, with reported water damage. The bridge on Route 504 was also affected.	5,000
3/30/1993	Coburn/Spring Mills. Penns Creek reported 0.3 feet above flood stage, resulting in closure of Penns Creek Road.	Not Provided (NP)
4/16/1993	Curtin. Lowland and basement flooding observed. A swinging bridge damaged by high water from Marsh Creek.	5,000
11/28/1993	Countywide. Many small streams out of their banks, road closures reported at Penns Valley, Bald Eagle, and Coburn.	NP
8/2/1994	Countywide. Small stream flooding was observed.	NP
8/18/1994	Countywide. Small stream flooding was observed.	NP
8/25/1994	Woodward. Minor flooding observed.	NP
1/20/1995	Countywide. Small stream and poor drainage flooding.	NP
1/12/1996	Countywide. Flash flood.	NP
6/17/1996	State College. Over 5 inches of rain fell in two hours flooding roads and basements in State College. The State College High School suffered damage to classrooms on the lowest level and to the swimming pool. Several labs at Penn State also were damaged. Between 80 and 100 homes in the area sustained some damage.	NP
9/6/1996	Port Matilda. Route 220 closed due to flooding.	NP
11/8/1996	Phillipsburg. Basement and minor road flooding occurred due to heavy rains.	NP
12/1/1996	Countywide. Flash flood	NP
6/18/1997	State College. Flash flood.	NP
1/8/1998	Countywide. Flash flood.	NP

Table 4.3.4-1: Flood, Flash Flood, and Heavy Rain Events Impacting Centre County from 1993-2020 (NCEI NOAA, 2020a).

DATE	LOCATION & DESCRIPTION	EST. PROPERTY DAMAGE ($)
4/26/1998	Countywide. Flash flood.	NP
1/23/1999	Countywide. Flash flood.	20,000
8/19/2001	State College. Slow moving thunderstorms caused Slab Cabin Run to rise out of its banks, with numerous reports of urban and poor drainage flooding were also noted.	NP
8/9/2003	Philipsburg. Numerous roadways in the area were quickly flooded from torrential thunderstorm rains.	NP
9/18/2003	Southern areas of the county. Heavy rain reported falling in southern portions of the State College county warning area (CWA). Rainfall amounts exceeded 3 inches in far southwestern areas, with much of the central CWA seeing in excess of 1 inch of rain.	NP
9/27/2003	Stormstown. Heavy rains caused flooding in Centre County. Road flooding was reported throughout the county. Hard hit were the intersections of Routes 220 and 550 in Stormstown, and portions of Julian Pike which were washed away by flood waters.	NP
11/19/2003	Port Matilda. Heavy rain caused rapid rises in streams, and produced flash flooding. This closed numerous roadways across the county, most notably roads in Port Matilda and Philipsburg.	NP
9/8/2004	Countywide. The remnants of Hurricane Frances moved northeast across central Pennsylvania from late Thursday afternoon on September 8th, into the early morning hours of Friday, September 9th, producing widespread heavy rainfall, and subsequent minor to moderate flooding. Rainfall amounts of 3 to 5 inches within a 12- to 18-hour period led to numerous road closures and widespread basement flooding across central Pennsylvania.	NP
9/17/2004	Countywide; As a result of this excessive rainfall from Hurricane Ivan and antecedent heavy rainfall from the remnants of Hurricane Frances one week earlier, widespread flooding occurred throughout central Pennsylvania from 9/17/2004 through 9/20/2004. Flood levels at many locations ranked in the top 5 for all flood events, with many river forecast points cresting above levels reached in the January 1996, flood. Overall, 32 of 47 river forecast points exceeded flood stage in central Pennsylvania, an all-time record high water mark, at Bald Eagle Creek at Beech Creek Station. The widespread flooding closed hundreds of roads and bridges across central Pennsylvania, causing a significant adverse impact on commerce and transportation for several days. Preliminary monetary estimates of flood damage from the remnants of Ivan across the state were over 260 million dollars.	NP
11/16/2006	State College. A strong cold front crossing the region triggered widespread severe weather and flash flooding across Central Pennsylvania. In State College, small streams came out of their banks, closing numerous roads and flooding basements.	NP

Table 4.3.4-1: Flood, Flash Flood, and Heavy Rain Events Impacting Centre County from 1993-2020 (NCEI NOAA, 2020a).

DATE	LOCATION & DESCRIPTION	EST. PROPERTY DAMAGE ($)
3/4/2008	Numerous locations. Heavy rain caused flooding and a number of road closures throughout Centre County. Roads were closed in the towns of Coburn and Milesburg, along with more roads in Boggs, College, Liberty, Penn, and Gregg Townships.	NP
12/1/2010	Countywide. Rainfall amounts between 2 and 4 inches produced significant flooding. The flooding closed several state, county and municipal roads in Howard, Curtin, Liberty, Potter, and Gregg Townships. The Borough of Milesburg declared a state of emergency and evacuated several residents from the Eagle Creek Trailer Park. The major flooding at confluence of Bald Eagle Creek and Moose Run caused extensive flooding in Milesburg. Unionville and Julian were also hit hard by the flooding. Numerous businesses and homes were affected in downtown Milesburg. U.S. Alternate 220 was closed from Skytop Mountain to Unionville. SR 45 westbound from Pine Grove Mills and Dogtown Road in Potter Township were closed. Water rescues were performed along South Eagle Valley Road in Huston Township. Spring Creek in Houserville came out of its banks and flooded nearby areas.	200,000
3/10/2011	Countywide. Heavy rain produced flooding and road closures over portions of the county.	NP
9/7/2011	Countywide. In Milesburg Borough, a trailer park and several roads were closed to flooding. Sporadic flooding was reported along Alt 220 along Bald Eagle Creek between Milesburg and Port Matilda.	NP
9/27/2011	Countywide. Thunderstorms caused flash flooding in portions of downtown State College. One foot of water was reported on portions of Atherton Street.	NP
6/27/2013	Countywide. Torrential rains produced flash flooding in the Centre region from Pine Grove Mills and State College through Bellefonte and Milesburg. The hardest hit area was from Milesburg northeast along Route 150 to the Blanchard/Beech Creek Area near the Centre/Clinton county line. Numerous roads were closed as a result of the event.	1,500,000
6/27/2013	Countywide. Flash flooding around the Centre region transitioned to areal flooding during the evening. The flood waters receded before midnight.	NP
7/10/2013	Countywide. Heavy thunderstorm rains caused flash flooding around State College. A few vehicles were stranded in standing water on Atherton Street near the bus terminal. This section of Atherton Street was briefly impassable. Thompson Run came out of its banks and closed the eastbound lane of College Avenue in front of the Your Building Center.	NP
8/1/2014	Countywide. Flash flooding prompted road closures due to high water including the eastbound lanes of College Avenue adjacent to Thompson Run in front of the Blaise Alexander auto dealership, Atherton Street from Park Avenue to College Avenue and Orchard Road between Park Avenue and Puddintown Road. A few cars were stranded in the flood waters.	NP

Table 4.3.4-1: Flood, Flash Flood, and Heavy Rain Events Impacting Centre County from 1993-2020 (NCEI NOAA, 2020a).

DATE	LOCATION & DESCRIPTION	EST. PROPERTY DAMAGE ($)
10/20/2016	Countywide. Intense rainfall led to flash floods across Centre County. Up to 8 inches of rain fell overnight in the 21st, causing major damage in the area. Infrastructure damages were assessed at around $2 million, impacting roadways, bridges, and culverts. Additionally, flooding resulted in school closures. Over 20 swift water rescue teams responded across the county, including Bald Eagle Creek in Milesburg. Additionally, a recent regional drought left soil unstable. This event resulted in widespread erosion and debris flow on agricultural lands.	$5,000,000
6/16/2017	Walker Township. Scattered thunderstorms resulted in localized flash flooding in the County. Zion Back Road in Walker Township was impacted by this event.	NP
8/3/2018	Countywide. Heavy rain led to flash flooding in the State College area. There were numerous road closures, including Benner Pike, Buffalo Run Road, Fox Hollow Road, Rock Road, West Pine Grove, and portions of East College Avenue.	NP

Note that property damage values are estimates based on best available information. "Countywide" indicates several locations in the County were affected.

Note that events from 1996 to present were recorded on the NOAA-NCEI Storm Events Database.

During the 2015 planning process, communities identified flooding caused by heavy thunderstorms had washed out roads in Gregg Township and that there had been flooding along Bald Eagle Creek in Milesburg Borough.

Attendees of the September 24, 2020 Risk Assessment and Mitigation Solutions Meeting also provided information about flood incidents in Centre County including:

- Bellefonte Borough noted that two floods occurred in their community in 2018. These events resulted in damages to parks and necessitated bridge repairs.
- Several communities noted an increase in frequency, impact, and extent of flood events since 2015.

Figure 4.3.4-9 illustrates the locations of ice jams in Centre County as documented in the USACE Ice Jam Database. These events have been concentrated in Milesburg Borough and Liberty, Benner, Burnside, and Rush Townships. Figure 4.3.4-10 depicts the location of NWS flash flood reports. These have occurred in State College Borough and Howard, Patton, Potter, and Walker Townships. Recent stakeholder meetings conducted by the Centre Region Planning Authority (CRPA) gathered input from all municipalities regarding flash flood events. Flash flooding along roadways has occurred more frequently in recent years. The October 2016 flood event caused significant flash flooding along PA Route 144 in Boggs Township. CRPA requested that PennDOT complete a feasibility study about drainage along the corridor, which is currently underway.

Figure 4.3.4-9: Location of Ice Jam Reports in Centre County (1984-2020)

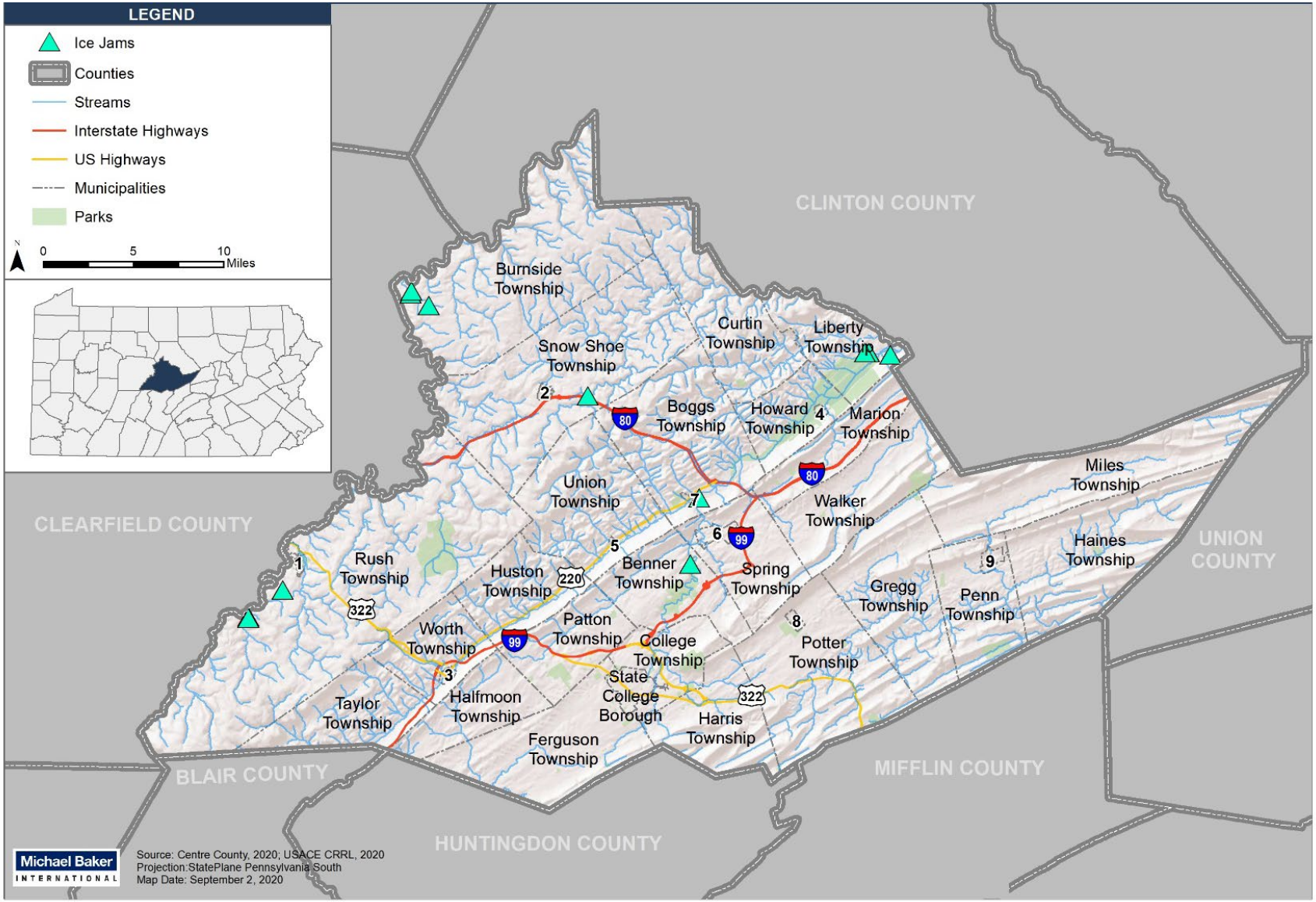
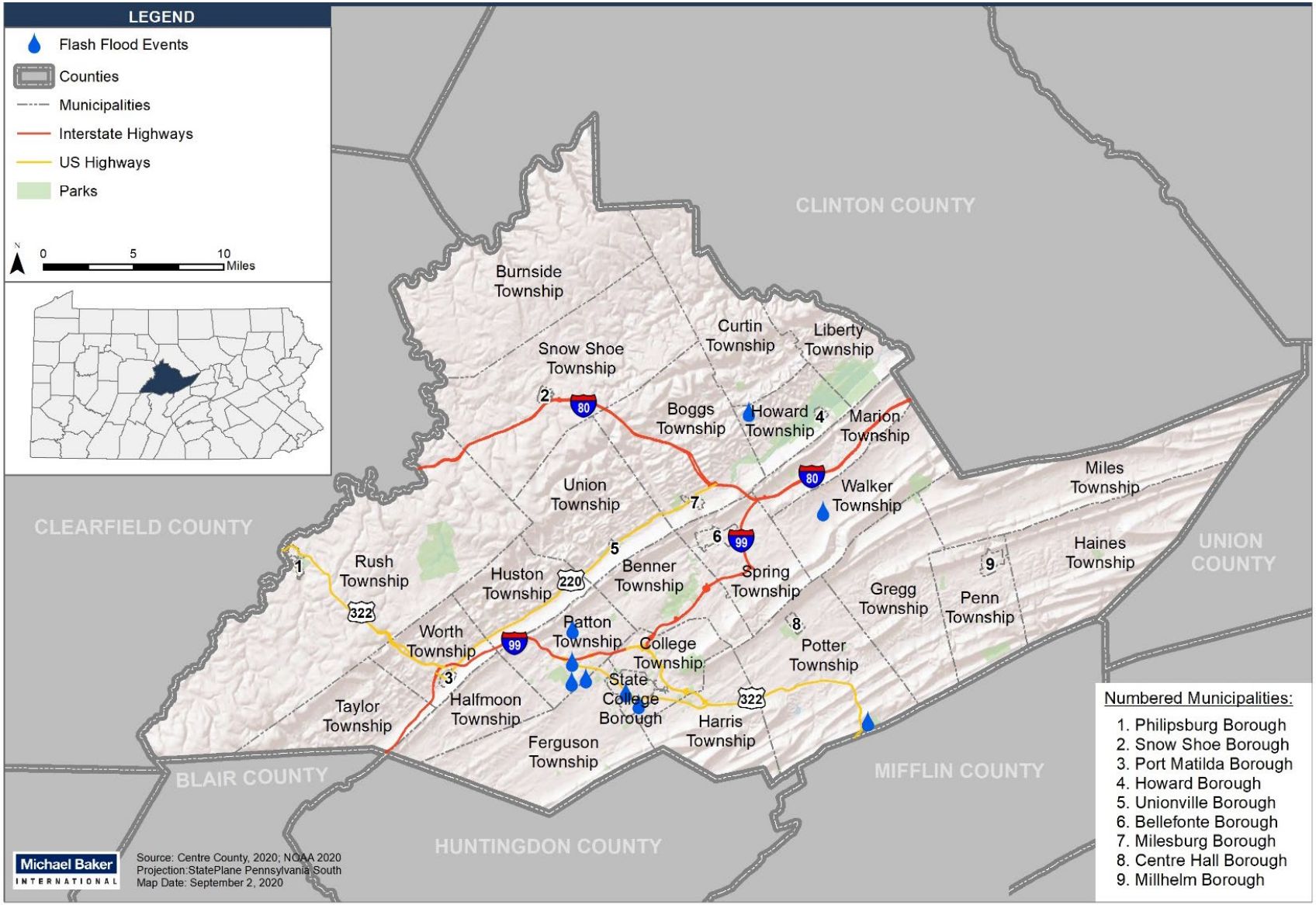


Figure 4.3.4-10: Location of Flash Flood Reports in Centre County, 2006-2020



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, floods are "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 NFIP.

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 companies 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, 2020b). 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 August 2020, Pennsylvania had a total of 51,568 policies in force across the state, 344 of which were in Centre County (FEMA CIS, 2020c).

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 Centre 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 to minimize or eliminate flood damage; and
- Anchor foundation or structure to resist floatation, collapse, or lateral movement.

Table 4.3.4-2 below indicates municipal participation in the NFIP. All but one community in Centre County are actively participating in the NFIP; Snow Shoe Borough was suspended from the NFIP in 2009.

Table 4.3.4-2: Centre County Municipal Participation in the NFIP (FEMA CIS, 2020a)

COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Bellefonte Borough	Participating	420257	2/2/1977	1/16/2015
Benner Township	Participating	421460	6/5/1989	1/16/2015
Boggs Township	Participating	421193	8/15/1989	5/4/2009
Burnside Township	Participating	421461	1/17/1986	5/4/2009
Centre Hall Borough	Participating	420258	5/4/2009	1/16/2015
College Township	Participating	420259	7/4/1989	5/4/2009
Curtin Township	Participating	421462	6/5/1989	5/4/2009
Ferguson Township	Participating	420260	7/17/1989	5/4/2009
Gregg Township	Participating	421194	11/2/1984	5/4/2009
Haines Township	Participating	420261	8/1/1978	5/4/2009
Halfmoon Township	Participating	421463	10/13/1978	5/4/2009
Harris Township	Participating	420262	6/5/1989	5/4/2009
Howard Borough	Participating	420263	8/3/1989	1/16/2015
Howard Township	Participating	421464	8/3/1989	1/16/2015
Huston Township	Participating	421195	6/5/1989	5/4/2009
Liberty Township	Participating	421196	6/5/1989	1/16/2015
Marion Township	Participating	421465	11/2/1984	5/4/2009
Miles Township	Participating	421197	12/4/1985	5/4/2009
Milesburg Borough	Participating	420264	2/2/1977	5/4/2009
Millheim Borough	Participating	420265	6/5/1989	5/4/2009
Patton Township	Participating	420266	2/19/1986	5/4/2009
Penn Township	Participating	421466	10/17/1989	5/4/2009
Philipsburg Borough	Participating	420267	08/15/1990	5/4/2009
Port Matilda Borough	Participating	420268	11/03/1989	5/4/2009
Potter Township	Participating	421467	02/05/1986	5/4/2009
Rush Township	Participating	421468	11/16/1990	5/4/2009
Snow Shoe Borough	Suspended	421459	08/10/1979	5/4/2009
Snow Shoe Township	Participating	421198	06/19/1989	5/4/2009
Spring Township	Participating	420269	04/15/1977	1/16/2015

Table 4.3.4-2: Centre County Municipal Participation in the NFIP (FEMA CIS, 2020a)

COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
State College Borough	Participating	420270	06/30/1976	5/4/2009
Taylor Township	Participating	421469	01/03/1986	5/4/2009
Union Township	Participating	421470	07/17/1989	5/4/2009
Unionville Borough	Participating	420272	11/03/1989	5/4/2009
Walker Township	Participating	421471	07/17/1989	5/4/2009
Worth Township	Participating	421472	08/15/1989	5/4/2009

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. No communities in Centre County are currently participating in the CRS.

Information on NFIP premiums and coverage, prior claims, and substantial damage claims provide additional information on past flood occurrences. Table 4.3.4-3 shows this information for each community in Centre County.

Table 4.3.4-3: Centre County NFIP Polices and Claims Information (FEMA CIS, 2020a) (FEMA CIS, 2020b)

COMMUNITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNGT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Bellefonte Borough	9	$2,669,055	18	$1,020,685	1
Benner Township	7	$1,324,397	6	$8,814	0
Boggs Township	34	$6,738,775	20	$49,671	0
Burnside Township	0	$0	5	$11,035	0
Centre Hall Borough	0	$0	2	$0	0
College Township	17	$5,171,372	32	$378,208	2
Curtin Township	7	$661,782	2	$13,698	0
Ferguson Township	21	$5,537,547	9	$43,787	0
Gregg Township	13	$1,649,688	19	$82,510	0
Haines Township	8	$1,283,631	11	$4,497	0
Halfmoon Township	6	$1,270,966	0	$0	0
Harris Township	7	$1,641,716	8	$9,108	0
Howard Borough	1	$28,116	0	$0	0
Howard Township	1	$161,486	0	$0	0
Huston Township	6	$790,315	2	$0	0
Liberty Township	17	$1,789,553	11	$41,549	0
Marion Township	1	$210,496	0	$0	0
Miles Township	27	$3,764,262	59	$528,285	0
Milesburg Borough	24	$2,685,853	10	$84,330	4

Table 4.3.4-3: Centre County NFIP Polices and Claims Information (FEMA CIS, 2020a) (FEMA CIS, 2020b)

COMMUNITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNGT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Millheim Borough	17	$4,528,357	5	$18,856	2
Patton Township	19	$2,172,451	46	$244,684	0
Penn Township	11	$1,599,196	21	$31,889	3
Philipsburg Borough	4	$751,025	2	$4,339	0
Port Matilda Borough	4	$994,521	8	$25,626	0
Potter Township	20	$2,976,830	27	$196,324	0
Rush Township*	0	$0	2	$2,427	1
Snow Shoe Borough	6	$838,674	0	$0	0
Snow Shoe Township	0	$0	3	$1,421	0
Spring Township	26	$6,193,713	18	$96,268	0
State College Borough	12	$3,571,449	5	$221,141	1
Taylor Township	5	$1,121,703	0	$0	0
Union Township	3	$841,317	3	$25,780	0
Unionville Borough	3	$158,901	5	$7,091	0
Walker Township	5	$874,542	7	$9,877	0
Worth Township	3	$1,502,582	0	$0	0
Total	344	$65,504,271	366	$3,161,900	14

**The CIS database provided separate totals for South Philipsburg Borough and Rush Township. As the South Philipsburg Borough has been annexed by Rush Township, information presented in the table above for Rush Township includes information for the area formerly incorporated as South Philipsburg Borough.*

In addition to the past flood events, the NFIP identifies 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 4.3.4-4 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 programs define 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 the 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 incidence 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.)

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 September 2018, there were 21 repetitive loss properties in Centre County, with five located in College Township. There are no severe repetitive loss buildings in Centre County (FEMA, 2018a). Table 4.3.4-4 shows the number of repetitive loss properties by municipality.

Table 4.3.4-4: Summary of the Number and Type of Repetitive Loss Properties by Municipality (FEMA, 2018a)

MUNICIPALITY	TYPE			SUM OF REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	NON-RESIDENTIAL	SINGLE FAMILY	
Bellefonte Borough	0	1	0	1
Boggs Township	0	1	2	3
College Township	0	0	5	5
Gregg Township	1	0	0	1
Milesburg Borough	0	1	2	3
Millheim Borough	0	0	1	1
Penn Township	1	0	2	3
Potter Township	0	0	1	1
Spring Township	0	0	2	2
State College Borough	0	1	0	1
Total	2	4	15	21

Data on the specific types on "non-residential" structures could not be obtained, but it is assumed to include primarily, but not be limited to, commercial and industrial structures. The majority of repetitive loss properties are single family residential structures.

4.3.4.4 Future Occurrence

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 Centre County FIRM. Areas subject to 2 percent- and 10 percent-annual-chance-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 (http://www.msc.fema.gov).Table 4.3.4-5 shows a range of flood recurrence intervals and associated probabilities of occurrence.

Table 4.3.4-5: Recurrence Intervals and Associated Probabilities of Occurrence (USGS, 2020a)

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

In Centre County, flooding occurs commonly and can take place 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 Centre County, it is expected that the character of flooding will remain essentially unchanged from what has been experienced for many years. However, some increase in the severity and frequency of flooding may result due to planned or recent development within the floodplains of the various streams, as well as increased intensity and frequency of rain events. Therefore, the future occurrence of floods in Centre County can be characterized as *likely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

Changing climates are increasing the frequency and magnitude of flood events. The Fourth National Climate Assessment identified more flooding occurring in the Northeast Region (US GCRP, 2018). Increasing temperatures are linked to increasing amounts and intensity of precipitation, which could increase frequency and severity of flood events. Climate Central projects that the region around State College could experience precipitation events about twice as hazardous by 2050 (Climate Central, 2019).

4.3.4.5 Vulnerability Assessment

Centre 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 local municipality showing the 1-percent-annual-chance flood hazard area, critical facilities impacted, and transportation routes are included in Appendix D - Local Municipality Flood Vulnerability Maps.

Table 4.3.4-6 displays the number of addressable structures, critical facilities, and populations intersecting the SFHA along with the total number of addressable structures, critical facilities, and population in each municipality. The critical facilities in this table excludes conventional and unconventional oil and gas wells. Due to the volume of wells in the County, the vulnerability of these facilities is analyzed independently as shown in Table 4.3.4-9. The numbers of vulnerable

addressable structures and critical facilities were calculated by overlaying the addressable structures with the SFHA as shown on the FIRM. Similarly, the estimated population in the SFHA was calculated by overlaying the centroids of Census blocks with the SFHA; while this is an estimate, using the block centroid helps to minimize overestimation of flood-prone populations.

Overall, three percent of the addressable structures and 34 percent of the population of Centre County are most at risk to the 1-percent-annual-chance flood zone. Liberty Township and Boggs Township have the highest number of addressable structures in the SFHA with 171 each, followed by Rush Township, which has 165 flood prone structures. Milesburg Borough has the highest percentage of structures (31 percent) in the SFHA. Based on this analysis, 15 of 35 Centre County communities have more than 50 percent of their populations living in the SFHA:

- Snow Shoe Borough (88%)
- State College Borough (83%)
- Ferguson Township (81%)
- Millheim Borough (78%)
- Curtin Township (73%)
- Haines Township (72%)
- Miles Township (71%)
- Centre Hall Borough (71%)
- Philipsburg Borough (70%)
- Boggs Township (64%)
- Howard Township (61%)
- Halfmoon Township (61%)
- Potter Township (58%)
- Patton Township (57%)
- Burnside Township (52%)

In the 2015 HMP, four municipalities had critical facilities located in the SFHA. Analyses for this Plan Update show that 15 municipalities have critical facilities (excluding oil and gas wells) located in the SFHA. This is primarily due to the expansion of the types of structures defined as critical facilities. In 2015, airports, EMS stations, fire stations, hospitals and medical centers, jails, and police stations were considered critical facilities. This Plan Update also includes dams, day care centers, nursing homes, personal care facilities, schools, water and sewer treatment plants, and Toxic Release Inventory (TRI) sites as critical facilities. Critical facilities in the SFHA primarily include dams and sewer and water treatment plants. There are two EMS, two fire stations, and one medical center located in the SFHA. There are also two personal care facilities and one day care center located in the SFHA. If not already implemented, these facilities could be considered for flood protection measures to protect emergency response efforts during events. As previously noted, unconventional and conventional oil and gas wells are considered critical facilities in this plan, but the vulnerability of these wells are analyzed separately (Table 4.3.4-9).

Table 4.3.4-7 shows the number of structures in the SFHA by generalized land use type. Most vulnerable structures (1,251) are residential properties, followed by recreation (137), commercial (112), and public or semi-public lands (63). Floods also have a significant impact on agricultural crops; especially vulnerable communities with extensive farmlands. Not only are crops lost in the immediate flood event, but often the remaining crops are of lesser quality, resulting in further losses. Additionally, there is the cost of replacing livestock feed lost to flooding. Because of the 1972 Agnes Flood, many industries and residents have prepared emergency plans, and some have established flood proofing procedures.

Table 4.3.4-6: Community Flood Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
Bellefonte Borough	2,658	55	2%	17	3	18%	7,457	1,988	27%
Benner Township	2,369	52	2%	26	1	4%	1,928	0	0%
Boggs Township	1,598	171	11%	9	2	22%	1,951	1,255	64%
Burnside Township	441	6	1%	3	0	0%	864	446	52%
Centre Hall Borough	579	0	0%	4	0	0%	573	406	71%
College Township	4,810	37	1%	44	1	2%	8,126	1,841	23%
Curtin Township	448	72	16%	2	0	0%	1,227	891	73%
Ferguson Township	6,949	61	1%	27	0	0%	2,482	2,017	81%
Gregg Township	1,179	117	10%	10	2	20%	2,220	881	40%
Haines Township	1,003	60	6%	7	0	0%	1,137	821	72%
Halfmoon Township	1,089	8	1%	5	0	0%	2,608	1,581	61%
Harris Township	2,798	4	0%	8	0	0%	24,486	11,172	46%
Howard Borough	298	4	1%	4	0	0%	46,258	3,714	8%
Howard Township	523	33	6%	1	0	0%	1,853	1,135	61%
Huston Township	684	84	12%	1	0	0%	20,404	6,083	30%
Liberty Township	1,233	171	14%	5	1	20%	11,607	5,220	45%
Marion Township	501	1	0%	3	0	0%	907	337	37%
Miles Township	944	13	1%	15	0	0%	4,539	3,233	71%
Milesburg Borough	475	148	31%	3	2	67%	501	143	29%
Millheim Borough	427	72	17%	4	1	25%	1,953	1,530	78%
Patton Township	5,315	11	0%	22	0	0%	2,356	1,354	57%
Penn Township	881	101	11%	15	4	27%	2,558	1,076	42%
Philipsburg Borough	1,309	61	5%	9	1	11%	2,095	1,462	70%

Table 4.3.4-6: Community Flood Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
Port Matilda Borough	256	15	6%	4	0	0%	1,128	254	23%
Potter Township	2,015	25	1%	15	0	0%	1,640	958	58%
Rush Township	2,462	165	7%	26	4	15%	3,911	1,702	44%
Snow Shoe Borough	346	0	0%	2	0	0%	1,177	1,040	88%
Snow Shoe Township	1,347	41	3%	8	3	38%	2,415	886	37%
Spring Township	3,654	81	2%	19	2	11%	4,954	1,942	39%
State College Borough	6,861	18	0%	36	0	0%	3,433	2,841	83%
Taylor Township	497	25	5%	1	0	0%	19,028	4,975	26%
Union Township	775	28	4%	5	2	40%	3,691	1,128	31%
Unionville Borough	134	10	7%	0	0	0%	5,525	2,272	41%
Walker Township	2,038	31	2%	13	1	8%	5,029	2,173	43%
Worth Township	471	5	1%	2	0	0%	5,598	2,068	37%
Total	**59,367**	**1,786**	**3%**	**375**	**30**	**8%**	**207,619**	**70,825**	**34%**

Table 4.3.4-7: Structures Vulnerable to Flooding (in SHFA) by Municipality and Land Use Type in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN THE SFHA																
		Agriculture	Commercial	Communications	Forests	Industrial	Mined Land	Mixed Use	Public/Semi-Public	Reclaimed Land	Recreation	Residential	Transportation	Utility	Vacant Land	Vacant Structure	Water	Total
Bellefonte Borough	2,658	0	7	0	1	6	0	0	13	0	2	15	1	1	6	3	0	55
Benner Township	2,369	3	3	0	3	0	0	0	10	0	1	24	3	1	3	0	1	52
Boggs Township	1,598	1	33	0	2	4	0	2	3	0	4	115	5	2	0	0	0	171
Burnside Township	441	0	0	0	2	0	0	0	0	0	0	4	0	0	0	0	0	6
Centre Hall Borough	579	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
College Township	4,810	2	0	0	1	0	0	0	6	0	3	20	0	3	2	0	0	37
Curtin Township	448	1	0	0	1	0	0	0	1	0	0	67	0	0	2	0	0	72
Ferguson Township	6,949	2	3	0	0	1	0	0	1	0	2	50	0	1	0	0	1	61
Gregg Township	1,179	1	2	0	0	1	0	7	8	0	2	84	0	2	1	9	0	117
Haines Township	1,003	0	1	0	1	0	0	0	0	0	20	37	1	0	0	0	0	60
Halfmoon Township	1,089	2	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	8
Harris Township	2,798	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	4
Howard Borough	298	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
Howard Township	523	0	1	0	1	0	0	0	1	0	13	4	3	1	0	0	9	33
Huston Township	684	0	5	0	0	0	0	0	2	0	1	74	0	0	2	0	0	84
Liberty Township	1,233	1	6	0	8	0	0	6	1	0	49	91	5	1	0	2	1	171
Marion Township	501	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Miles Township	944	0	0	0	1	0	0	0	0	0	0	12	0	0	0	0	0	13
Milesburg Borough	475	0	5	0	1	0	0	0	3	0	2	134	0	2	0	1	0	148
Millheim Borough	427	0	6	0	0	0	0	14	0	0	3	48	0	0	0	1	0	72

Table 4.3.4-7: Structures Vulnerable to Flooding (in SHFA) by Municipality and Land Use Type in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN THE SFHA																
		Agriculture	Commercial	Communications	Forests	Industrial	Mined Land	Mixed Use	Public/Semi-Public	Reclaimed Land	Recreation	Residential	Transportation	Utility	Vacant Land	Vacant Structure	Water	Total
Patton Township	5,315	1	0	0	2	0	0	0	0	0	0	4	4	0	0	0	0	11
Penn Township	881	2	2	0	1	0	0	2	1	0	12	79	0	1	0	0	1	101
Philipsburg Borough	1,309	0	5	0	0	0	0	3	2	0	3	46	0	1	1	0	0	61
Port Matilda Borough	256	0	1	0	0	0	0	0	0	0	2	11	0	1	0	0	0	15
Potter Township	2,015	1	1	0	0	0	0	0	2	0	2	19	0	0	0	0	0	25
Rush Township	2,462	0	14	0	5	0	0	1	6	1	8	123	0	2	2	1	0	165
Snow Shoe Borough	346	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snow Shoe Township	1,347	1	0	0	1	1	0	2	0	0	2	30	1	1	0	1	1	41
Spring Township	3,654	0	5	0	1	3	0	0	0	0	3	66	1	2	0	0	0	81
State College Borough	6,861	0	10	0	0	0	0	0	0	0	0	7	0	0	0	0	1	18
Taylor Township	497	0	0	0	0	0	0	0	1	0	0	20	1	3	0	0	0	25
Union Township	775	0	2	0	1	0	0	1	0	0	2	21	0	1	0	0	0	28
Unionville Borough	134	0	0	0	0	0	0	0	1	0	1	8	0	0	0	0	0	10
Walker Township	2,038	0	0	1	1	0	0	0	1	0	0	24	0	2	1	0	1	31
Worth Township	471	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	0	5
Total	**59,367**	**18**	**112**	**1**	**34**	**17**	**0**	**39**	**63**	**1**	**137**	**1,251**	**28**	**29**	**20**	**18**	**16**	**1,786**

The United States Environmental Protection Agency's (EPA) Toxics Release Inventory tracks the management of certain toxic chemicals that may pose a threat to human health and the environment. Facilities releasing and/or managing these chemicals through recycling, energy recovery, and treatment must report annual amounts used to the EPA. Table 4.3.4-8 takes a closer look specifically at TRI facility flood vulnerability in Centre County. Ten municipalities in the County have 26 TRI facilities, three of which (11.5 percent) are located in the SFHA. Bellefonte Borough (Graymont (PA) Inc.), Snow Show Township (Snow Shoe Refractories LLC/Clarence PLT), and Milesburg Borough (Hilex Poly Co LLC) each have one TRI facility in the SFHA. Communities that are not listed do not have any TRI facilities.

Table 4.3.4-8: TRI Facility Flood Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL TRI FACILITIES	TOTAL TRI FACILITIES IN SFHA	PERCENT TRI FACILITIES IN SFHA
Bellefonte Borough	8	1	12.5%
Centre Hall Borough	1	0	0%
Howard Borough	1	0	0%
Miles Township	1	0	0%
Milesburg Borough	1	1	100%
Philipsburg Borough	1	0	0%
Snow Shoe Township	1	1	10%
Spring Township	1	0	0%
State College Borough	10	0	0%
Walker Township	1	0	0%
Total	**26**	**3**	**11.5%**

Table 4.3.4-9 shows conventional and unconventional oil and gas wells that are vulnerable to flooding in Centre County. Flooding of oil and gas wells can cause damage to the operations. Wells are prone to ruptured flow lines and storage tanks, which could cause environmental harm. Only two municipalities have oil and gas wells that are prone to flooding. Curtin Township has one well and Snow Shoe Township has two in the SFHA.

Table 4.3.4-9: Conventional and Unconventional Oil and Gas Well Flood Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL OIL AND GAS WELLS	TOTAL OIL AND GAS WELLS IN SFHA	PERCENT OIL AND GAS WELLS IN SFHA
Boggs Township	51	0	0%
Burnside Township	683	0	0%
Curtin Township	192	1	1%
Liberty Township	2	0	0%

Table 4.3.4-9: Conventional and Unconventional Oil and Gas Well Flood Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL OIL AND GAS WELLS	TOTAL OIL AND GAS WELLS IN SFHA	PERCENT OIL AND GAS WELLS IN SFHA
Marion Township	1	0	0%
Rush Township	60	0	0%
Snow Shoe Township	615	2	0%
Taylor Township	2	0	0%
Union Township	7	0	0%
Worth Township	3	0	0%
Total	**1,616**	**3**	**0.2%**

The flood vulnerability of mobile homes in Centre County is shown in Table 4.3.4-10. Those living in mobile homes in the SFHA are at greatest risk to flood complications. In order to estimate the number of mobile home structures in the SFHA, addressable structures that fall within parcels with the land use "mobile home" were selected, then the structures were intersected with the SFHA. A total of 32 municipalities in Centre County have mobile homes. Of those municipalities, 21 contain mobile homes in the SFHA. Huston Township features the most mobile homes in the SFHA (48) followed by Rush Township (31), while Unionville Borough and Milesburg Borough have the highest percentage of mobile homes in the SFHA at 83.33 percent and 61.36 percent, respectively. Some communities have very low proportions of mobile homes in the SFHA, including Ferguson Township (1.30 percent), Howard Township (1.54 percent), Halfmoon Township (2.17 percent), and Union Township (2.21 percent).

Table 4.3.4-10: Mobile Home Flood Vulnerability in Centre County

MUNICIPALITY	TOTAL MOBILE HOMES	# MOBILE HOMES IN SFHA	% MOBILE HOMES IN SFHA
Bellefonte Borough	10	0	0%
Benner Township	655	0	0%
Boggs Township	253	14	5.53%
Burnside Township	80	0	0%
Centre Hall Borough	6	0	0%
College Township	0	0	0%
Curtin Township	73	5	6.85%
Ferguson Township	77	1	1.30%
Gregg Township	71	7	9.86%
Haines Township	59	2	3.39%
Halfmoon Township	46	1	2.17%
Harris Township	0	0	0%
Howard Borough	0	0	0%

Table 4.3.4-10: Mobile Home Flood Vulnerability in Centre County

MUNICIPALITY	TOTAL MOBILE HOMES	# MOBILE HOMES IN SFHA	% MOBILE HOMES IN SFHA
Howard Township	65	1	1.54%
Huston Township	153	48	31.37%
Liberty Township	176	8	4.55%
Marion Township	19	0	0%
Miles Township	64	0	0%
Milesburg Borough	44	27	61.36%
Millheim Borough	21	4	19.05%
Patton Township	48	0	0%
Penn Township	84	10	11.90%
Philipsburg Borough	120	19	15.83%
Port Matilda Borough	31	1	3.23%
Potter Township	312	0	0%
Rush Township	120	31	25.83%
Snow Shoe Borough	21	0	0%
Snow Shoe Township	153	1	0.65%
Spring Township	61	2	3.28%
State College Borough	70	7	10.00%
Taylor Township	84	4	4.76%
Union Township	136	3	2.21%
Unionville Borough	6	5	83.33%
Walker Township	173	0	0%
Worth Township	29	0	0%
Total	3,320	201	6.05%

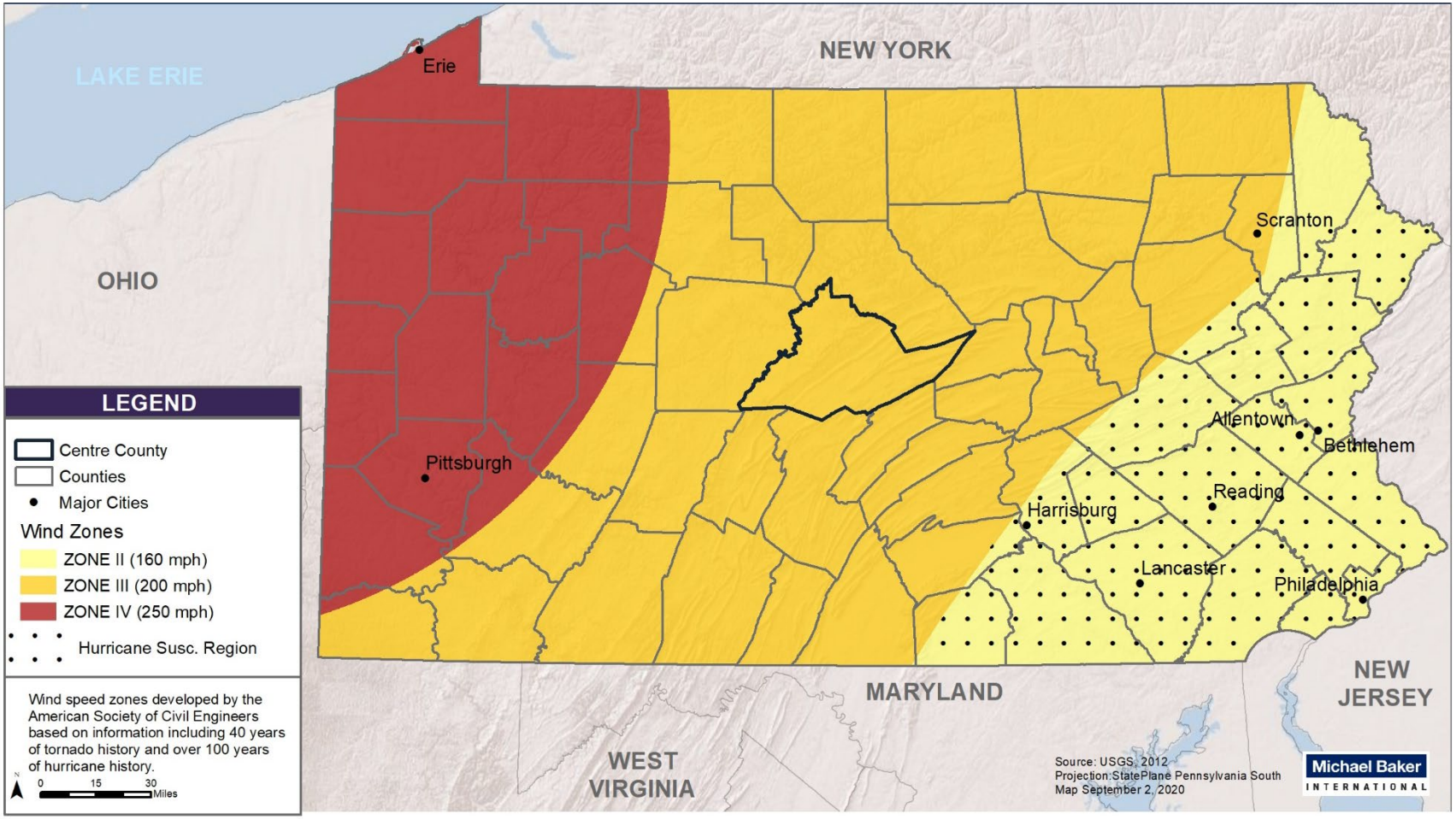
4.3.5 Hurricane, Tropical Storm, Nor'easter

4.3.5.1 Location and Extent

Tropical storms impacting Centre 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 Centre County is located over 200 miles from the Atlantic Coast, 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 the storm. Therefore, all communities within Centre County are equally subject to the impacts of hurricanes, tropical storms, and Nor'easters. Areas subject to flooding, wind, and winter storm damage are particularly vulnerable.

Figure 4.3.5.1 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. This is the most recent data available. 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. Centre County falls within Zone III, meaning design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. More detail on tornados and windstorms is discussed in Section 4.3.11.

Figure 4.3.5-1: Wind Speed Zones in Centre County, 2012



4.3.5.2 Range of Magnitude

The impacts associated with hurricanes and tropical storms are primarily wind damage and flooding. It is not uncommon for tornadoes to develop during these events. Historical tropical storm and hurricane 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 remains of Hurricane Ivan (2004) dumped seven inches of rain on the County in 12 to 14 hours. This resulted in major flooding, reaching the 500-year floodplain in some parts of the County, such as the Central City area of Milesburg Borough. In other areas, such as Millheim Borough, though flooding occurred, it did not reach the level of the 1972 Agnes flooding event. In general terms, areas that traditionally had not flooded previously flooded on this occurrence, and areas that traditionally flood either did not, or not to the extent that would have been predicted for an event of this magnitude. In some areas, new bridges that were engineered to be above the Agnes flood waters, such as the bridge over Spring Creek at Lamb and Water streets in Bellefonte Borough, were water covered. This flood clearly illustrates that Centre County's floodplains have been impacted by continued construction, paving, and other development activity. For the purposes of this HMP, the 2004 Hurricane Ivan event remains the worst-case hurricane event, with Hurricane Agnes considered as a worst-case flood event. The impacts from these two tropical systems were extensive throughout Centre County, and while overall attributable damage estimates were not available for this plan, the range of impacts from these events are invaluable for hazard mitigation planning purposes.

The impact tropical storm or hurricane events have on an area is 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 Centre County), which are combined to estimate potential damage. Table 4.3.5-1 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 4.3.5-1: Saffir-Simpson Scale Categories with Associated Wind Speeds and Damages (NHC, 2009)

STORM CATEGORY	WIND SPEED (MPH)	DESCRIPTION OF DAMAGES
1	74-95	MINIMAL: Damage is limited primarily to shrubbery and trees, unanchored mobile homes and signs. No significant structural damage.
2	96-110	MODERATE: Some trees are toppled, some roof coverings are damaged, and major damage occurs to mobile homes. Some roofing material, door and window damage.

Table 4.3.5-1: Saffir-Simpson Scale Categories with Associated Wind Speeds and Damages (NHC, 2009)

STORM CATEGORY	WIND SPEED (MPH)	DESCRIPTION OF DAMAGES
3	111-130	EXTENSIVE: Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Large trees are toppled. Terrain may be flooded well inland.
4	131-155	EXTREME: Extensive damage to roofs, windows, and doors; roof systems on small buildings completely fail. More extensive curtain wall failures. Terrain may be flooded well inland.
5	>155	CATASTROPHIC: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Massive evacuation of residential areas may be required.

The likelihood of these damages occurring in Centre County is assessed in Section 4.3.5.4. It is important to recognize the potential for flooding during hurricane, tropical storm, and Nor'easter events; the risk assessment for these events is included Section 4.3.4. Environmental impacts associated with hurricanes and tropical storms are consistent with the impacts described for flooding in Section 4.3.4.2 and tornadoes and windstorms in Section 4.3.11.2. The impact of severe winter weather which sometimes occurs during Nor'easter events is discussed in Section 4.3.13.2.

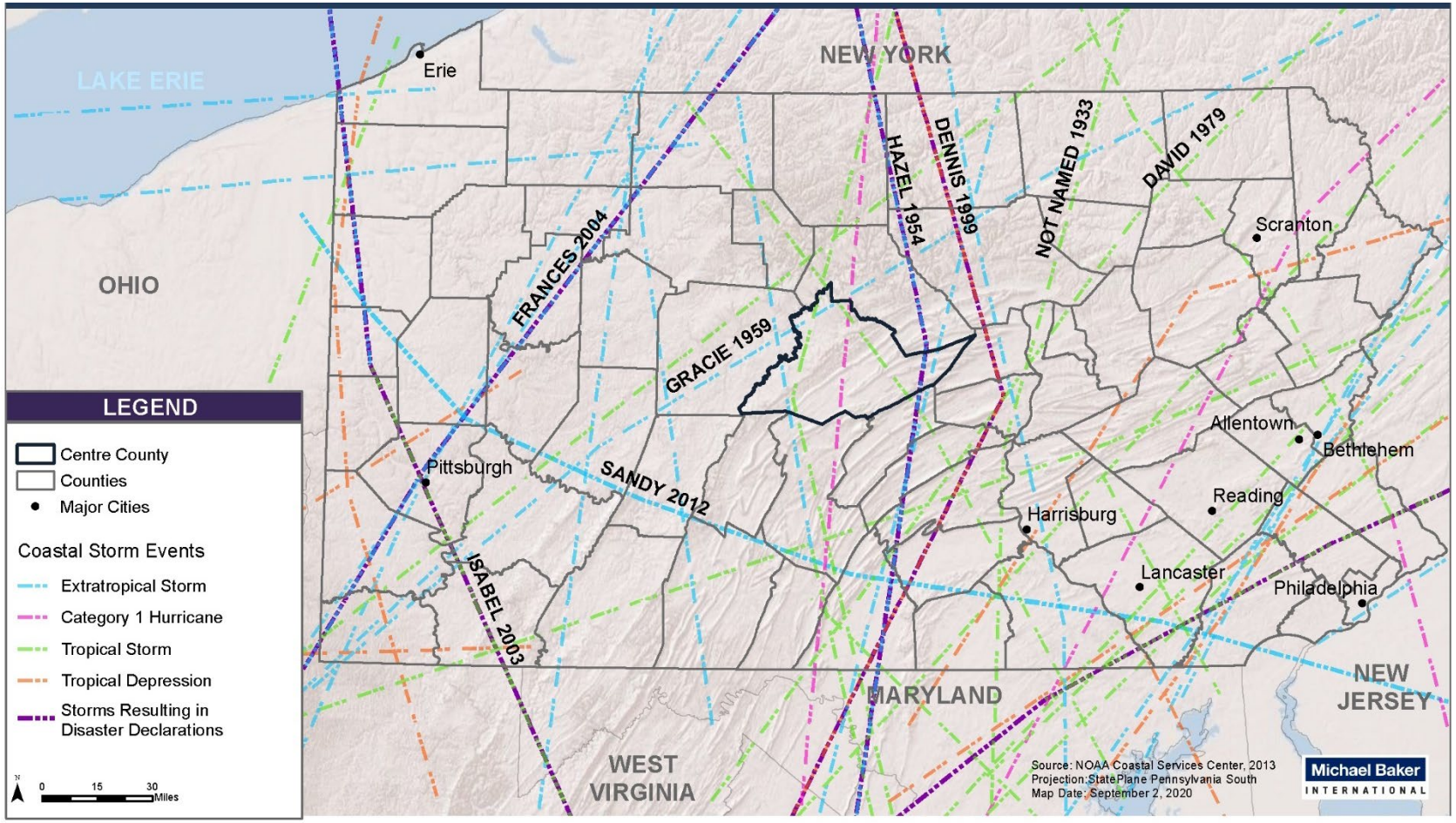
4.3.5.3 Past Occurrence

Figure 4.3.5-2 shows historic coastal storms which have passed through the Commonwealth of Pennsylvania. As previously stated, even if a storm did not pass through Centre County, the wind and rain from the storm could have still impacted the County.

Table 4.3.5-2: Previous Tropical Storm Events Affecting Centre County (NOAA NCEI, 2020a)

YEAR	EVENT
1972	Tropical Storm Agnes
1975	Hurricane Eloise
1979	Tropical Storm Frederic
1999	Hurricane Dennis
1999	Hurricane Floyd
2003	Tropical Storm Isabel
2004	Hurricane Frances
2004	Tropical Depression Ivan
2011	Tropical Storm Lee
2012	Hurricane Sandy
2013	Tropical Storm Andrea
2017	Tropical Storm Cindy
2018	Tropical Storm Gordon
2020	Tropical Storm Fay

Figure 4.3.5-2: Historic Coastal Storms in Pennsylvania, 2009



Of the storms listed in Table 4.3.5-2, Tropical Storm Agnes was the most devastating event the County experienced. Agnes made landfall in Florida as a minimal hurricane. However, as it combined with a non-tropical low over the Mid-Atlantic Region to produce rainfall amounts of up to 19 inches in some locations. Table 4.3.5-3 provides a breakdown of the damages by municipality and flood source.

Table 4.3.5-3: Distribution of Flood Damages by Municipality and Flood Source from Tropical Storm Agnes

MUNICIPALITY	FLOOD SOURCE	DAMAGES ($)
Borough of State College	Slab Cabin Run	N/A
Borough of Bellefonte	Spring Creek	1,975,000
Borough of Howard	Lick Run	304,000
Borough of Milesburg	Bald Eagle Creek	436,000
Borough of Port Matilda	Bald Eagle Creek	54,000

4.3.5.4 Future Occurrence

Although hurricanes and tropical storms can cause flood events consistent with 100- and 500-year levels, their probability of occurrence is measured relative to wind speed. Table 4.3.5-4 shows the probability of winds that reach the strength of tropical storms and hurricane conditions in Centre County and surrounding areas based on a statistical sample region of more than 30,000 square miles over a period of 46 years.

Table 4.3.5-4: Annual Probability of Tropical Storm and Hurricane Strength Wind Speeds in Centre County and Surrounding Areas (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 4.3.5-4 includes wind speeds for all types of storms and is not specific to cyclonic winds. In Centre 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 8 percent in any given year. Using Table 4.3.5-1, 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 included as Figure 4.3.5-4 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 a 6-12 percent chance of Centre County experiencing a tropical storm or hurricane event between June and November of any given year. The probability of future Hurricane, Tropical Storms, and Nor'easters impacting the County can be considered *possible* according to the Risk Factor Methodology (see Table 4.4-1).

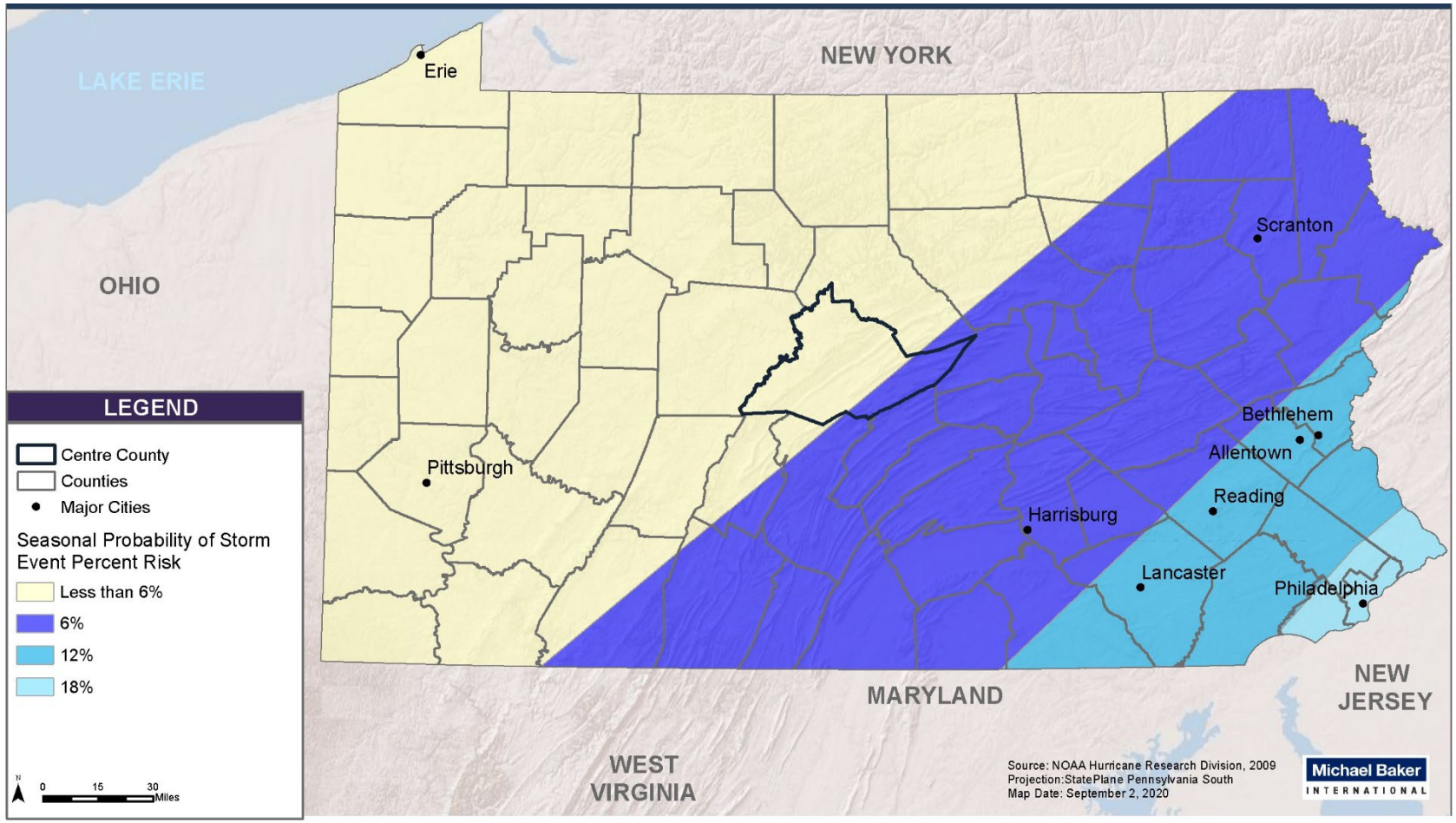
4.3.5.5 Vulnerability Assessment

A vulnerability assessment for hurricanes and tropical storms focuses on the impacts of flooding and severe wind. Centre County is vulnerable to the impact of flooding and severe wind caused by hurricanes, tropical storms, and Nor'easters. Historic data indicates that while storm tracks do not typically track over Centre County, impacts from associated rain can be felt in low-lying communities vulnerable to flooding events, such as Milesburg, Millheim, Phillipsburg, and Bellefonte Boroughs. These more compact communities are near flood prone watercourses such as Spring and Pine Creek. Milesburg Borough is particularly vulnerable as it lies at the confluence of Spring Creek and the Upper Bald Eagle Creek.

A detailed assessment of Centre County's flood-related vulnerability is addressed in Section 4.3.4, while its vulnerability to wind damage is addressed in Section 4.3.11. Centre County may also be vulnerability to severe winter weather impacts caused by Nor'easters, as evaluated in Section 4.3.13.

Figure 4.3.5-3: Centre County OES Responding to a Flood Event

Figure 4.3.5-4: Seasonal Probability of a Hurricane or Tropical Storm Affecting Centre County, 2009



4.3.6 Landslide

4.3.6.1 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, erosion, earthquakes, and changes in groundwater levels. Mudflows, mudslides, rockfalls, rockslides, and rock topples are all forms of landslide (DCNR, 2020a). Landslides usually occur in areas of Centre 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.

The diverse topography of Centre County is characterized by extremes in elevation. The highest elevation is 2,600 feet above sea level at the Blair County line in Rush Township. The lowest elevation, 575 feet above sea level, is in the Bald Eagle Creek channel at the Clinton County Line. The wide differences in elevation in the various parts of Centre County have resulted in a substantial part of the land area being identified as moderately to steeply sloping. Figure 4.3.6-1 shows areas of low, moderate, and high landslide susceptibility as determined by the U.S. Geological Survey. There is a strip of low incidence area running Northeast through the center of the County. The majority of the County is rated as moderate incidence with high susceptibility.

Figure 4.3.6-2 shows the steep slope soils in Centre County as defined by the Natural Resources Conservation Service (NRCS). A slope greater than 7 percent (approximately 15°) needs special considerations for building roads according to common engineering practice, and a slope 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 Centre County.

While Centre County encompasses a variety of susceptibility, at the local level only minor landslides in the form of falling rock and/or mud slides have occurred to date. No serious injury, death, or property damage has occurred in the County as a result of a landslide incident.

The majority of these landslides occur along road and highway cuts through the mountains.

Figure 4.3.6-1: Landslide Susceptibility and Incidence in Centre County, 2001

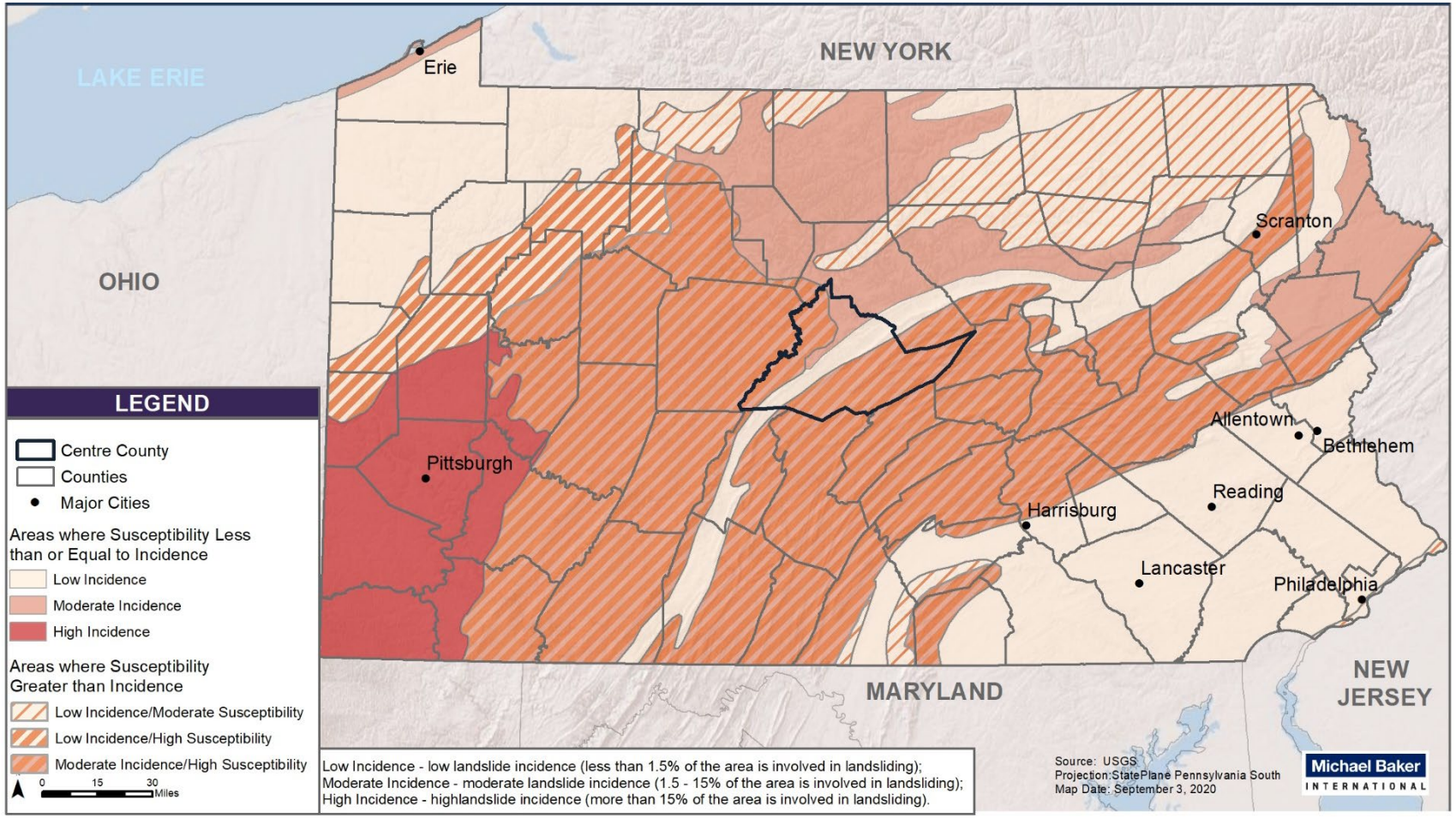
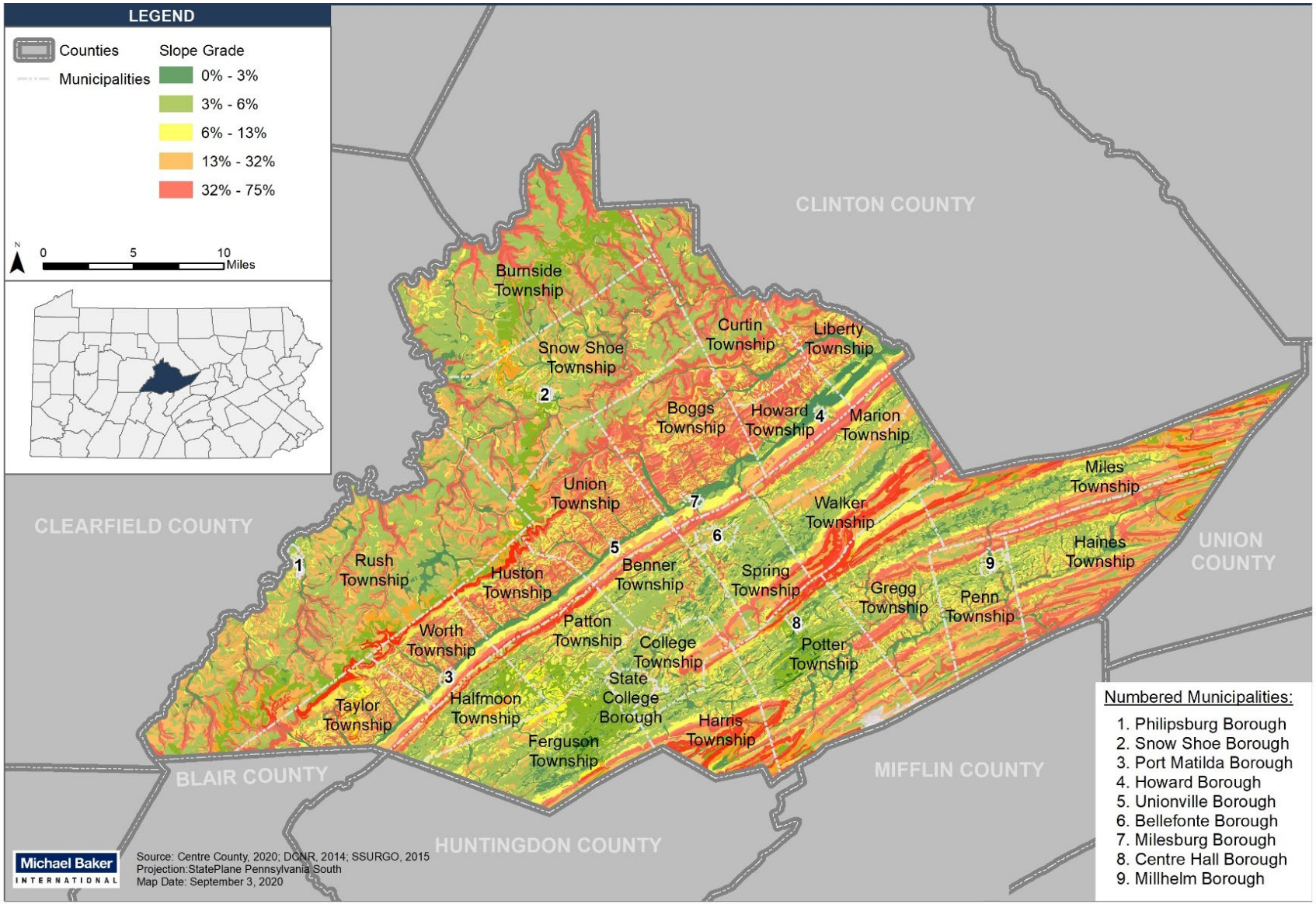


Figure 4.3.6-2: Landslide Susceptibility by Slope Grade in Centre County, 2015



4.3.6.2 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 in Centre County have reportedly involved a small amount of rocks tumbling down a hillside; here, a small amount means an amount sufficient to fill the shoulder of a road for a linear distance of about 10 feet with rock, but not enough to block the entire roadway. A more damaging scenario could occur in Centre County if a landslide occurred along one of the major interstates. The landslide could cause damage to vehicles and the roadway and injuries to people. In addition, the landslide would have secondary effects caused by shutting down the roadway. Storm induced debris flows are the only other type of landslide likely to cause death and injuries. As residential and recreational development increases on and near steep mountain slopes, the hazard from these rapid events will also increase. Most Pennsylvania landslides are moderate to slow moving and damage things rather than people.

Potential damage due to landslides in Centre County is limited to roadway closures and the possibility of highway accidents due to debris deposited on the roadway. No dollar estimates on expenditures by PennDOT for debris removal for specific Centre County events were available for inclusion in this document. The threat of landslides is greatest along high-volume traffic areas, especially where the road travels through a cut in the topography. A worst-case scenario event for planning purposes would involve the I-80 corridor traversing the higher risk areas of Snow Shoe Township. Crushed vehicles, stranded motorists, economic impacts due to disruptions in freight movement, as well as the cost to clear debris would result from this scenario.

4.3.6.3 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; the NCDC database does not report any landslides in Centre County. However, representatives from the County and municipal officials identified several incidents within the County. Landslide activity occurred along transportation corridors during the 1972 Hurricane Agnes event. Outside of impacts to important transportation routes, landslide history is not documented as completely (if at all) as other hazards, primarily because landslides are not always seen. Beyond debris avalanches associated with significant rain and flooding activity, only minor landslides in the form of falling rock and/or mud slides have occurred in Centre County to date. Landslides with

minor impact are defined as landslides impacting five or less developed properties or causing $1,000,000 or less damage. Minor landslides typically are incidents that have been 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 59 of these events have been recorded by NCEI since 1996, which are shown in Table 4.3.6-1. No heavy snow events have occurred since 2015.

Table 4.3.6-1: Heavy Rain and Heavy Snow Events in Centre County (NOAA NCEI, 2020a)

LOCATION	DATE	EVENT TYPE
Southern Centre (Zone)	1/2/1996	Heavy Snow
Northern Centre (Zone)	1/2/1996	Heavy Snow
Southern Centre (Zone)	1/12/1996	Heavy Snow
Northern Centre (Zone)	3/7/1996	Heavy Snow
Southern Centre (Zone)	3/7/1996	Heavy Snow
Southern Centre (Zone)	11/28/1996	Heavy Snow
Northern Centre (Zone)	11/14/1997	Heavy Snow
Southern Centre (Zone)	11/14/1997	Heavy Snow
Southern Centre (Zone)	12/29/1997	Heavy Snow
Northern Centre (Zone)	12/29/1997	Heavy Snow
Southern Centre (Zone)	2/23/1998	Heavy Snow
Northern Centre (Zone)	3/4/1999	Heavy Snow
Southern Centre (Zone)	3/6/1999	Heavy Snow
Northern Centre (Zone)	3/6/1999	Heavy Snow
Northern Centre (Zone)	3/14/1999	Heavy Snow
Southern Centre (Zone)	3/14/1999	Heavy Snow
Northern Centre (Zone)	1/30/2000	Heavy Snow
Southern Centre (Zone)	1/30/2000	Heavy Snow
Southern Centre (Zone)	3/4/2001	Heavy Snow
Northern Centre (Zone)	3/4/2001	Heavy Snow
Southern Centre (Zone)	1/6/2002	Heavy Snow
Northern Centre (Zone)	1/6/2002	Heavy Snow
Northern Centre (Zone)	12/4/2002	Heavy Snow
Southern Centre (Zone)	12/4/2002	Heavy Snow
Southern Centre (Zone)	12/25/2002	Heavy Snow
Northern Centre (Zone)	12/25/2002	Heavy Snow
Northern Centre (Zone)	1/2/2003	Heavy Snow
Southern Centre (Zone)	1/2/2003	Heavy Snow
Southern Centre (Zone)	2/16/2003	Heavy Snow
Northern Centre (Zone)	2/16/2003	Heavy Snow
Northern Centre (Zone)	3/30/2003	Heavy Snow

Table 4.3.6-1: Heavy Rain and Heavy Snow Events in Centre County (NOAA NCEI, 2020a)

LOCATION	DATE	EVENT TYPE
Northern Centre (Zone)	12/4/2003	Heavy Snow
Southern Centre (Zone)	12/4/2003	Heavy Snow
Northern Centre (Zone)	12/14/2003	Heavy Snow
Northern Centre (Zone)	1/14/2004	Heavy Snow
Southern Centre (Zone)	1/14/2004	Heavy Snow
Southern Centre (Zone)	2/3/2004	Heavy Snow
Northern Centre (Zone)	2/3/2004	Heavy Snow
Northern Centre (Zone)	3/16/2004	Heavy Snow
Southern Centre (Zone)	3/16/2004	Heavy Snow
Southern Centre (Zone)	3/19/2004	Heavy Snow
Northern Centre (Zone)	3/19/2004	Heavy Snow
Southern Centre (Zone)	2/24/2005	Heavy Snow
Northern Centre (Zone)	3/1/2005	Heavy Snow
Southern Centre (Zone)	3/1/2005	Heavy Snow
Northern Centre (Zone)	10/25/2005	Heavy Snow
Southern Centre (Zone)	12/9/2005	Heavy Snow
Northern Centre (Zone)	12/9/2005	Heavy Snow
Northern Centre (Zone)	2/13/2007	Heavy Snow
Southern Centre (Zone)	3/16/2007	Heavy Snow
Northern Centre (Zone)	3/16/2007	Heavy Snow
Northern Centre (Zone)	3/6/2011	Heavy Snow
Southern Centre (Zone)	3/6/2011	Heavy Snow
Southern Centre (Zone)	10/29/2011	Heavy Snow
Northern Centre (Zone)	10/29/2011	Heavy Snow
Northern Centre (Zone)	4/22/2012	Heavy Snow
Southern Centre (Zone)	2/13/2014	Heavy Snow
Northern Centre (Zone)	2/13/2014	Heavy Snow
Southern Centre (Zone)	11/25/2014	Heavy Snow

However, rainstorms in October 2016 resulted in a landslide that led to road failure along Purdue Mountain Road in Benner Township as is shown in Figure 4.3.6-3. The Township worked with PEMA and FEMA to secure grant funding to help address the failure. After the road was closed for more than a year, the road damage was ultimately addressed in August 2018.

Figure 4.3.6-3: Road Failure Along Purdue Mountain Road in Benner Township, 2016 (Benner Township, 2018)

4.3.6.4 Future Occurrence

Significant landslide events are unlikely in the County. However, there is the possibility of some rock falling from a steep slope, given that this 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 Centre County is considered potential 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, as noted in Section 4.3.4, Centre County anticipates an increase in the frequency and magnitude of flood events as a result of increasing amounts and intensity of precipitation. Increased rainfall has also been shown to increase occurrences of landslide events. Therefore, the probability of future landslide events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.6.5 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 Centre 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. The County has indicated that roads where this potential exists are marked with warning signs and barriers have been installed in areas where significant rock fall or landsliding is likely. 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 continue, the risk of significant landslides increases.

Table 4.3.6-2 summarizes the number of existing structures and critical facilities (excluding oil and gas wells) in Centre County that are located in areas with steep slopes. Approximately 11 percent of all structures in the County are located on slopes greater than 15 percent. Bellefonte Borough has the most structures located on a slope with over 560 structures. Spring Township (448) and Patton Township (409) also have a large number of structures in landslide prone areas. Penn Township and Worth Township have the greatest percentage of structures located on slopes over 15 percent, with 31 percent and 28 percent, respectively. A total of 18 municipalities contained critical facilities on steep slopes totaling 29 facilities. Critical facilities vulnerable to landslides are primarily dams and water treatment plants. Landslide events at these facilities could lead to the secondary effect of flood hazards. There are also several emergency response facilities prone to landslide hazards: one EMS and one fire station. Two medical centers and one nursing home are also within the landslide hazard area.

Table 4.3.6-3 shows the number of oil and gas wells that are in areas susceptible to landslides. Landslides have the potential to disrupt and damage oil and gas well operations. Damage to the operations could cause environmental harm. In Centre County, approximately 33 percent of all oil and gas wells are located on slopes greater than 15 percent, which makes them prone to landslides. Snow Shoe Township has 223 wells that are vulnerable, and Burnside Township has 177. All municipalities with oil and gas wells have at least one well vulnerable to landslides. Table 4.3.6-4 depicts the number of structures in each municipality located in areas susceptible to landslides due to steep slopes by land use type. The land use type displaying the greatest vulnerability to landslide hazards is residential with 5,428 structures. Residential structures accounted for 83 percent of all vulnerable structures in Centre County. Forest and transportation were the next most vulnerable land uses, followed by recreation and commercial.

Table 4.3.6-2: Structures and Critical Facilities Vulnerable to Landslides in Centre County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON SLOPES >15%	PERCENT STRUCTURES ON SLOPES >15%	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON SLOPES >15%	PERCENT CRITICAL FACILITIES ON SLOPES >15%
Bellefonte Borough	2,658	563	21%	17	0	0%
Benner Township	2,369	291	12%	26	1	4%
Boggs Township	1,598	386	24%	9	0	0%
Burnside Township	441	70	16%	3	0	0%
Centre Hall Borough	579	32	6%	4	0	0%
College Township	4,810	335	7%	44	2	5%
Curtin Township	448	113	25%	2	2	100%
Ferguson Township	6,949	230	3%	27	2	7%
Gregg Township	1,179	236	20%	10	2	20%
Haines Township	1,003	184	18%	7	2	29%
Halfmoon Township	1,089	147	13%	5	1	20%
Harris Township	2,798	200	7%	8	1	14%
Howard Borough	298	0	0%	4	0	0%
Howard Township	523	121	23%	1	1	100%
Huston Township	684	172	25%	1	0	0%
Liberty Township	1,233	247	20%	5	1	20%
Marion Township	501	117	23%	3	2	67%
Miles Township	944	134	14%	15	2	13%
Milesburg Borough	475	31	7%	3	0	0%
Millheim Borough	427	12	3%	4	1	25%
Patton Township	5,315	409	8%	22	2	9%
Penn Township	881	272	31%	15	2	13%
Philipsburg Borough	1,309	40	3%	9	0	0%
Port Matilda Borough	256	5	2%	4	0	0%
Potter Township	2,015	278	14%	15	0	0%
Rush Township	2,462	354	14%	26	2	8%
Snow Shoe Borough	346	21	6%	2	0	0%
Snow Shoe Township	1,347	248	18%	8	0	0%

Table 4.3.6-2: Structures and Critical Facilities Vulnerable to Landslides in Centre County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON SLOPES >15%	PERCENT STRUCTURES ON SLOPES >15%	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON SLOPES >15%	PERCENT CRITICAL FACILITIES ON SLOPES >15%
Spring Township	3,654	448	12%	19	0	0%
State College Borough	6,861	171	2%	36	0	0%
Taylor Township	497	117	24%	1	0	0%
Union Township	775	201	26%	5	0	0%
Unionville Borough	134	11	8%	0	0	0%
Walker Township	2,038	193	9%	13	2	15%
Worth Township	471	132	28%	2	1	50%
Total	**59,367**	**6,521**	**11%**	**375**	**29**	**8%**

Table 4.3.6-3: Conventional and Unconventional Oil and Gas Well Landslide Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL OIL AND GAS WELLS	TOTAL OIL AND GAS WELLS ON SLOPES OVER 15%	PERCENT OIL AND GAS WELLS ON SLOPES OVER 15%
Boggs Township	51	22	43%
Burnside Township	683	177	26%
Curtin Township	192	79	41%
Liberty Township	2	1	50%
Marion Township	1	1	100%
Rush Township	60	26	43%
Snow Shoe Township	615	223	36%
Taylor Township	2	1	50%
Union Township	7	2	29%
Worth Township	3	1	33%
Total	**1,616**	**533**	**33%**

Table 4.3.6-4: Structure by Land Use Landslide Vulnerability in Centre County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES LOCATED IN LANDSLIDE-PRONE AREAS																
		Agriculture	Commercial	Comms.	Forests	Industrial	Mined land	Mixed use	Public/semi-public	Reclaimed land	Recreation	Residential	Transportation	Utility	Vacant land	Vacant Structure	Water	Total
Bellefonte Borough	2,658	0	11	0	1	4	0	15	6	0	0	517	9	0	0	0	0	563
Benner Township	2,369	3	2	5	5	1	0	0	4	0	0	254	7	1	9	0	0	291
Boggs Township	1,598	6	6	4	12	2	1	2	3	0	6	316	28	0	0	0	0	386
Burnside Township	441	0	1	0	4	0	4	0	1	2	0	56	1	0	1	0	0	70
Centre Hall Borough	579	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	32
College Township	4,810	4	39	0	5	0	0	0	3	0	1	264	10	3	6	0	0	335
Curtin Township	448	2	0	1	4	0	0	0	1	0	1	99	0	2	2	1	0	113
Ferguson Township	6,949	4	1	0	21	1	0	0	0	0	0	193	6	3	1	0	0	230
Gregg Township	1,179	2	2	0	8	0	0	6	4	0	0	207	2	1	1	3	0	236
Haines Township	1,003	2	8	0	17	0	0	0	0	0	18	130	6	2	1	0	0	184
Halfmoon Township	1,089	7	2	3	10	0	0	0	0	0	0	122	1	2	0	0	0	147
Harris Township	2,798	3	0	0	10	0	0	0	1	0	2	147	3	1	33	0	0	200
Howard Borough	298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Howard Township	523	2	6	1	2	0	0	1	1	0	0	104	1	1	1	1	0	121
Huston Township	684	1	7	2	6	0	0	1	2	0	0	145	7	0	1	0	0	172
Liberty Township	1,233	1	0	0	9	0	0	0	2	0	1	231	0	2	1	0	0	247
Marion Township	501	2	1	1	11	0	0	0	1	0	0	95	3	2	1	0	0	117
Miles Township	944	1	0	2	11	0	0	0	0	0	0	108	9	2	1	0	0	134
Milesburg Borough	475	0	0	0	0	0	0	0	0	0	0	30	0	1	0	0	0	31
Millheim Borough	427	0	0	0	0	0	0	1	0	0	0	10	0	1	0	0	0	12
Patton Township	5,315	1	5	0	16	6	0	0	0	0	0	364	9	2	6	0	0	409
Penn Township	881	3	1	4	9	0	0	1	1	0	59	192	0	2	0	0	0	272
Philipsburg Borough	1,309	0	1	0	1	0	0	0	1	0	0	36	0	0	0	0	0	40
Port Matilda Borough	256	0	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	5

Table 4.3.6-4: Structure by Land Use Landslide Vulnerability in Centre County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES LOCATED IN LANDSLIDE-PRONE AREAS																
		Agriculture	Commercial	Comms.	Forests	Industrial	Mined land	Mixed use	Public/semi-public	Reclaimed land	Recreation	Residential	Transportation	Utility	Vacant land	Vacant Structure	Water	Total
Potter Township	2,015	0	2	1	10	0	2	1	9	0	1	242	5	1	4	0	0	278
Rush Township	2,462	0	4	4	11	1	2	0	7	3	39	241	3	4	3	0	0	354
Snow Shoe Borough	346	0	2	0	0	0	0	0	0	0	0	19	0	0	0	0	0	21
Snow Shoe Township	1,347	3	4	2	17	2	9	1	1	5	0	190	8	0	6	0	0	248
Spring Township	3,654	0	14	7	9	0	1	1	4	0	0	399	3	6	4	0	0	448
State College Borough	6,861	0	10	0	4	0	0	0	2	0	0	154	0	1	0	0	0	171
Taylor Township	497	1	0	1	4	1	0	2	1	0	0	94	5	4	4	0	0	117
Union Township	775	0	0	3	6	0	0	0	1	0	0	170	20	0	1	0	0	201
Unionville Borough	134	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	11
Walker Township	2,038	1	0	0	31	0	0	0	0	0	0	155	0	5	1	0	0	193
Worth Township	471	1	1	5	6	1	0	1	0	0	0	97	18	2	0	0	0	132
Total	**59,367**	**50**	**130**	**46**	**260**	**19**	**19**	**33**	**57**	**10**	**128**	**5,428**	**164**	**51**	**88**	**5**	**0**	**6,521**

4.3.7 Lighting Strike

Lightning is a rapid discharge of electrical energy in the atmosphere. When the charge difference between the ground and the cloud becomes too large, a conductive channel of air develops between the cloud and the ground, and a small amount of charge (step leader) starts moving toward the ground. When it nears the ground, an upward leader of opposite charge connects with the step leader. At the instant this connection is made, a powerful discharge occurs between the cloud and the ground. This discharge is seen as a bright visible flash of lightning.

4.3.7.1 Location and Extent

Lightning events occur across the entire Commonwealth. Different areas experience varying event frequencies, but in all cases, lightning strikes occur primarily during the summer months. While the impact of flash events is highly localized, strong storms can result in numerous widespread events over a broad area. In addition, the impacts of an event can be serious or widespread if lightning strikes a particularly significant location, such as a power station or large public venue.

More than 100,000 thunderstorms occur in the United States each year, with lightning striking more than 25 million points on the ground during that same period. This causes an average of 20 fatalities and hundreds of injuries each year (NOAA, 2020b). Lightning can occur with all thunderstorms, of which the entire county is susceptible. Lightning fatalities are most common during the summer and during the afternoon and evening.

4.3.7.2 Range of Magnitude

Because lightning damage is largely unreported, statistics vary considerably. The insurance industry, however, estimates 6.5 percent of all property/casualty claims are related to lightning strikes (Credit Union National Association, 2015). While it is difficult to quantify lightning losses, it is estimated that $4-5 billion damage occurs each year. Likewise, the cost of lightning protection to safeguard critical equipment and facilities from lightning strikes during severe weather is enormous. In statistics kept from 1959-1994, Pennsylvania was reported to have the largest number of damage reports due to lightning of any state, with 1,441 (Curran, 1999).

The worst-case scenario for a lightning strike is envisioned to occur during a capacity football game at Beaver Stadium, located on the Penn State University campus. Large outdoor stadiums face a significant and growing vulnerability to lightning due to the size of crowds. There are, however, relatively few college football games held over the course of the year, and even fewer held during seasons most susceptible to lightning activity. While to date, there have been few casualties in the United States from direct lightning strikes to a stadium or from the mass movement of spectators when lightning threatens, the HMSC wanted to recognize this potential, albeit extremely low-risk, event.

4.3.7.3 Past Occurrence

Records from the NCEI show that there were 657 lightning events in the 57 counties across Pennsylvania between 1950 and 2018. A lightning "event" is defined as a lightning strike that results in fatality, injury, and/or property or crop damage (NOAA NWS, 2016).

Total deaths caused by lightning from 1990 to 2003 were collected for each state, ranking Pennsylvania sixth (25 deaths) in the country (NLSI, 2020). From 1959 to 1994, Pennsylvania ranked third among all states with 644 casualties (i.e., combination of deaths and injuries) (NOAA NWS, 1997). This represents approximately 5 percent of casualties, which occurred throughout the United States over that 35-year period.

Pennsylvania ranked first among all states in the United States with 1,441 damage reports. However, it is unclear what the total dollar value is for these damages, and there is no account of the spatial distribution of damages below the state level (Curran, 1999). In 2019, Pennsylvania ranked eighth in the nation for number of homeowner's insurance claims for lightning losses, with 2,838 claims. These claims valued approximately $27.3 million, with each claim costing an average of $9,600 (III, 2020).

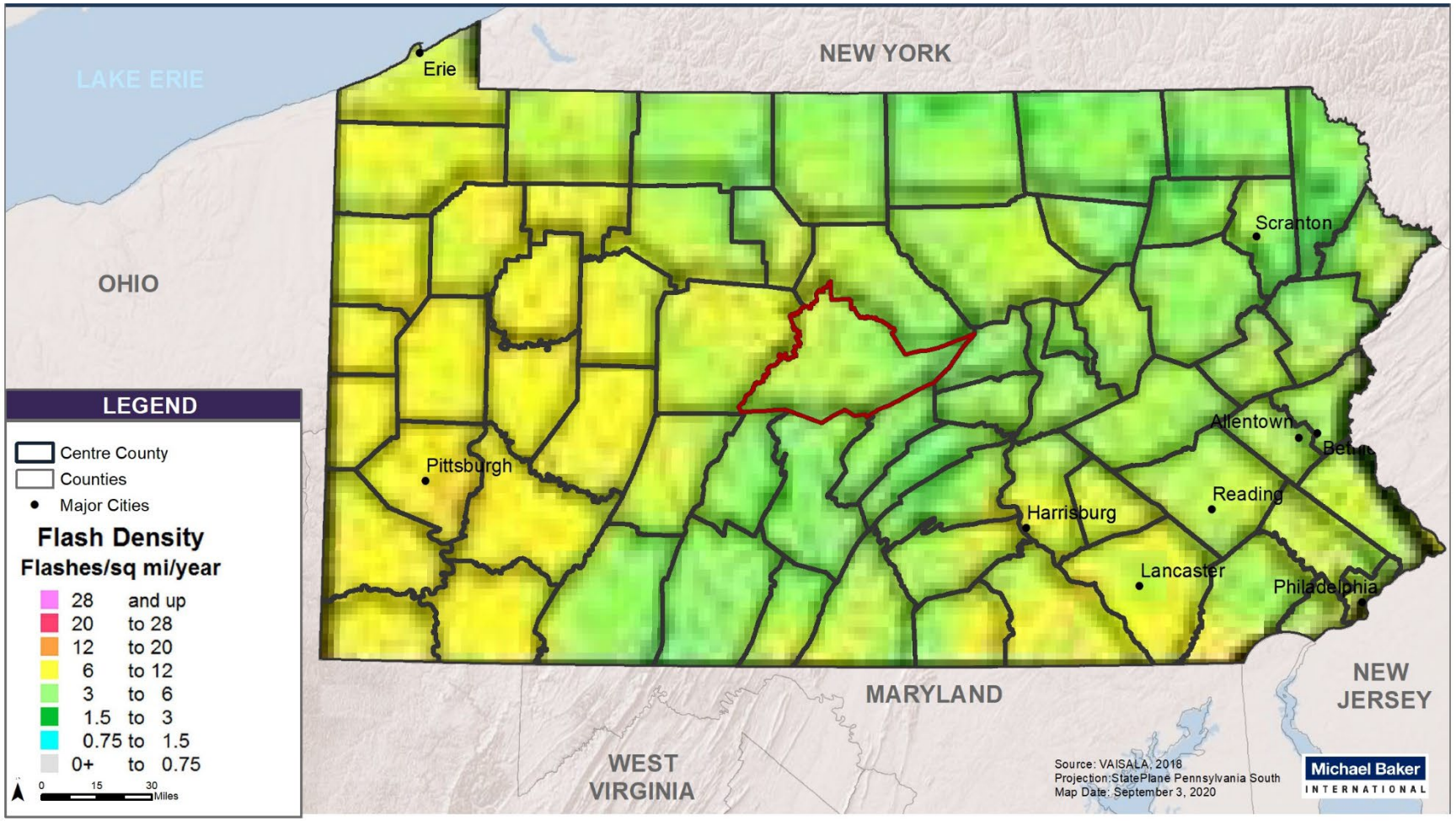
Figure 4.3.7-1 shows how the lightning strike incident rate in Centre County compares with the rest of the state.

4.3.7.4 Future Occurrence

The future occurrence of lightning and thunderstorm activity in Centre County is anticipated, and the susceptibility to damage from these severe storms will remain unchanged. However, the probability of lighting strike events resulting in multiple casualties or extensive structural damage is considered *unlikely* according to the Risk Factor Methodology (see Table 4.4-1).

The number of lightning events are influenced by the frequency of a severe thunderstorm occurrence. Therefore, potential future changes in climate and weather conditions may impact the future occurrences of lightning strike. According to the Pennsylvania Climate Impacts Assessment Update, thunderstorms are projects to increase in frequency (Shortle et al, 2015). However, the future occurrence of lightning activity is not forecasted as lightning strikes are frequent and widespread and forecasters' understanding of the cloud electrification process is incomplete (NOAA NSSL, 2018).

Figure 4.3.7-3: Lightning event history for Pennsylvania and Centre County, 2009-2018



4.3.7.5 Vulnerability Assessment

The potential for lightning strikes and thunderstorms will always exist for all 35 municipalities in Centre County. Outdoors activities and events are particularly vulnerable, and when lightning threatens a large outdoor venue, the game or event itself is usually postponed. Penn State University utilizes advanced technology and software applications from a private vendor to monitor weather conditions in real time, delivering information via cell phone to keep personnel ahead of the weather. Coaches and trainers use lightning information to get athletes off the field or move practice indoors. Penn State University is a StormReady University, a designation obtained through participation in the NWS StormReady Program, which includes six guidelines met by Penn State University, namely:

- Communication and Coordination - A control center must be fully staffed at all times to implement severe weather procedures.
- Warning Reception – At least four redundant systems in place at the control center to receive weather warnings.
- Hydrometeorological Monitoring – At least three methods of monitoring weather conditions must be present in the control center.
- Local Warning Dissemination – There must be at least three redundant systems to notify the University community of severe weather warnings
- Community Preparedness – There must be plans in place at the University for building occupants to follow in the event of severe weather.
- Administration – The University must also meet a number of administrative criteria that include ongoing coordination with NWS staff, training of staff, and reporting procedures in place to notify the NWS of damages caused by storms on campus.

Losses due to lightning can be lessened by installing surge protection on critical electronic, lightning, or information technology systems. Lightning protection devices and methods, such as lightning rods and grounding, can be installed on a community's communications infrastructure and other critical facilities to reduce losses.

4.3.8 Radon Exposure

4.3.8.1 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, Pennsylvania, showed that the readings on Mr. Stanley Watras frequently exceeded expected radiation levels, yet only natural, non-fission-product radioactivity was detected on him. Radon levels in his home were detected around 2,500 pCi/L (pico Curies per Liter), much higher than the 4 pCi/L guideline of the Environmental Protection Agency or even the 67 pCi/L limit for uranium miners. As a result of this event, the Reading Prong section of Pennsylvania where Watras lived 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.

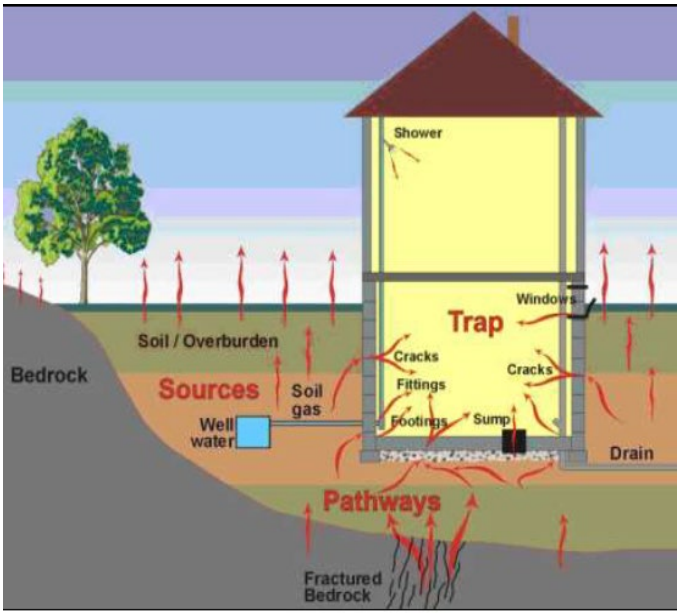
The distribution of radon is correlated with the distribution of radium (i.e. 226Ra), its immediate radioactive parent, and with uranium, its original ancestor. Due to the short half-life of radon, the distance that radon atoms can travel from their parent before decay is generally limited to distances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

Three sources of radon in houses are now recognized (shown in Figure 4.3.8-1):

- 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 4.3.8-1: 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 4.3.8-1). 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. Centre County is classified as having a high hazard, meaning there is a predicted indoor radon level greater than 4 pCi/L (see Figure 4.3.8-2).

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. The importance of carbonate soils is indicated by the fact that radon contents in 93 percent of a sample of houses built on limestone-dolomite soils near State College, Centre County, exceeded 4 pCi/L, and 21 percent exceeded 20 pCi/L, even though the uranium values in the underlying bedrock are all in the normal range of 0.5 to 5 ppm uranium.

The second factor listed above is most likely the cause of radon levels in Centre County, although high test results may be a result of multiple factors. Figures 4.3.8-3, 4.3.8-4, 4.3.8-5, and 4.3.8-6 show the radon test data available for Centre County by zip code. As shown in Figure 4.3.8-3, most communities have average basement radon readings of over the threshold of action of 11 pCi/L, while many communities had maximum basement readings over 200 pCi/L (see Figure 4.3.8-4).

The highest recorded basement radon readings in Centre County were 535.6 pCi/L in State College Borough, 256.6 in Benner Township, 246.1 in Port Matilda Borough, and 238.5 in Bellefonte. First floor average radon levels were substantially lower than average test results for basement, but many communities still exceeded the 4pCi/L threshold, which is shown in Figure 4.3.8-5. Additionally, maximum first floor radon levels were much lower than those for basements, but all exceeded the threshold of action. Communities with no data available did not have a sufficient sample size.

Figure 4.3.8-2: Radon Hazard Zones in Pennsylvania, 2014

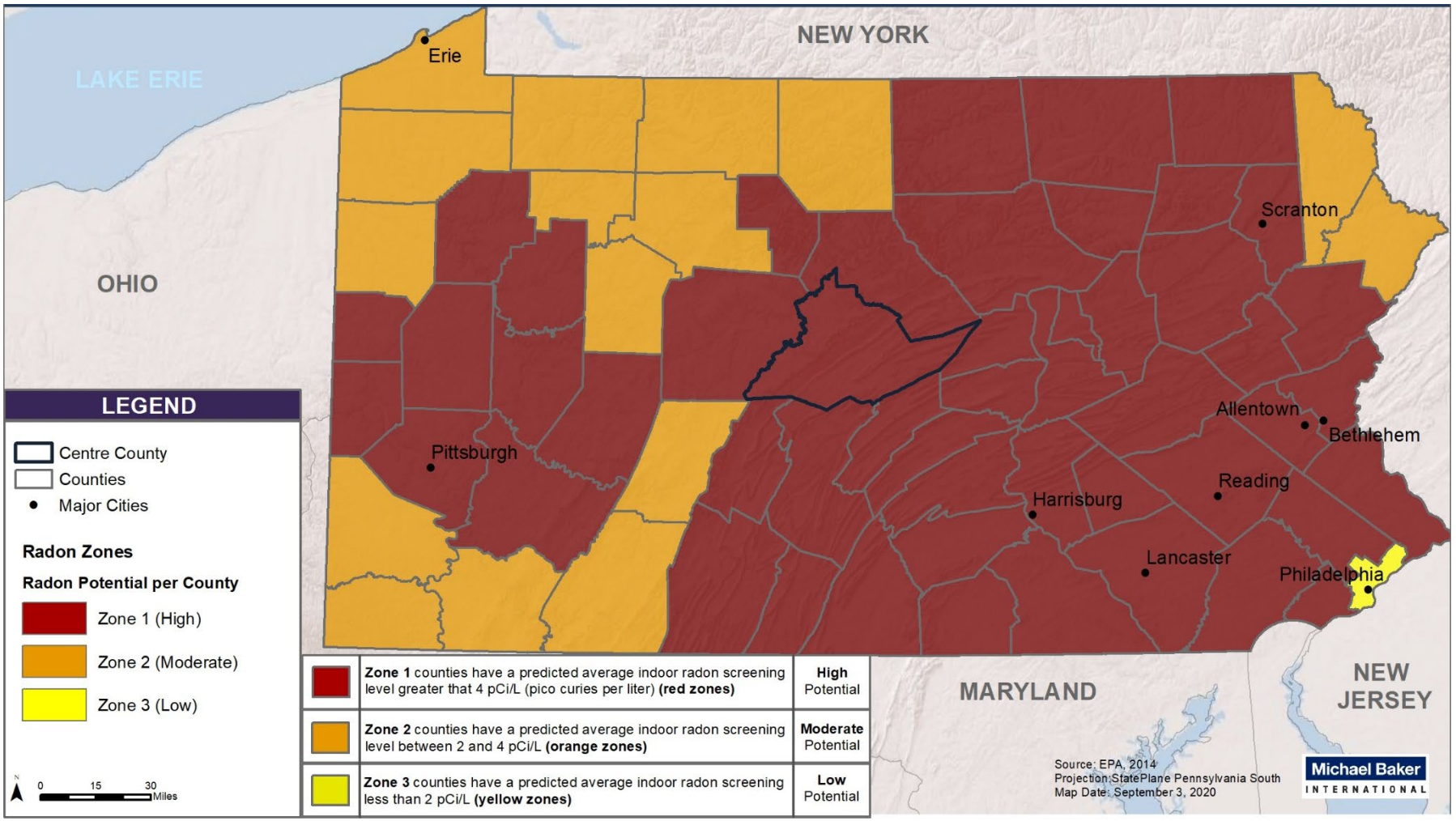


Figure 4.3.8-3: Centre County Average Basement Radon Test Results, 2020

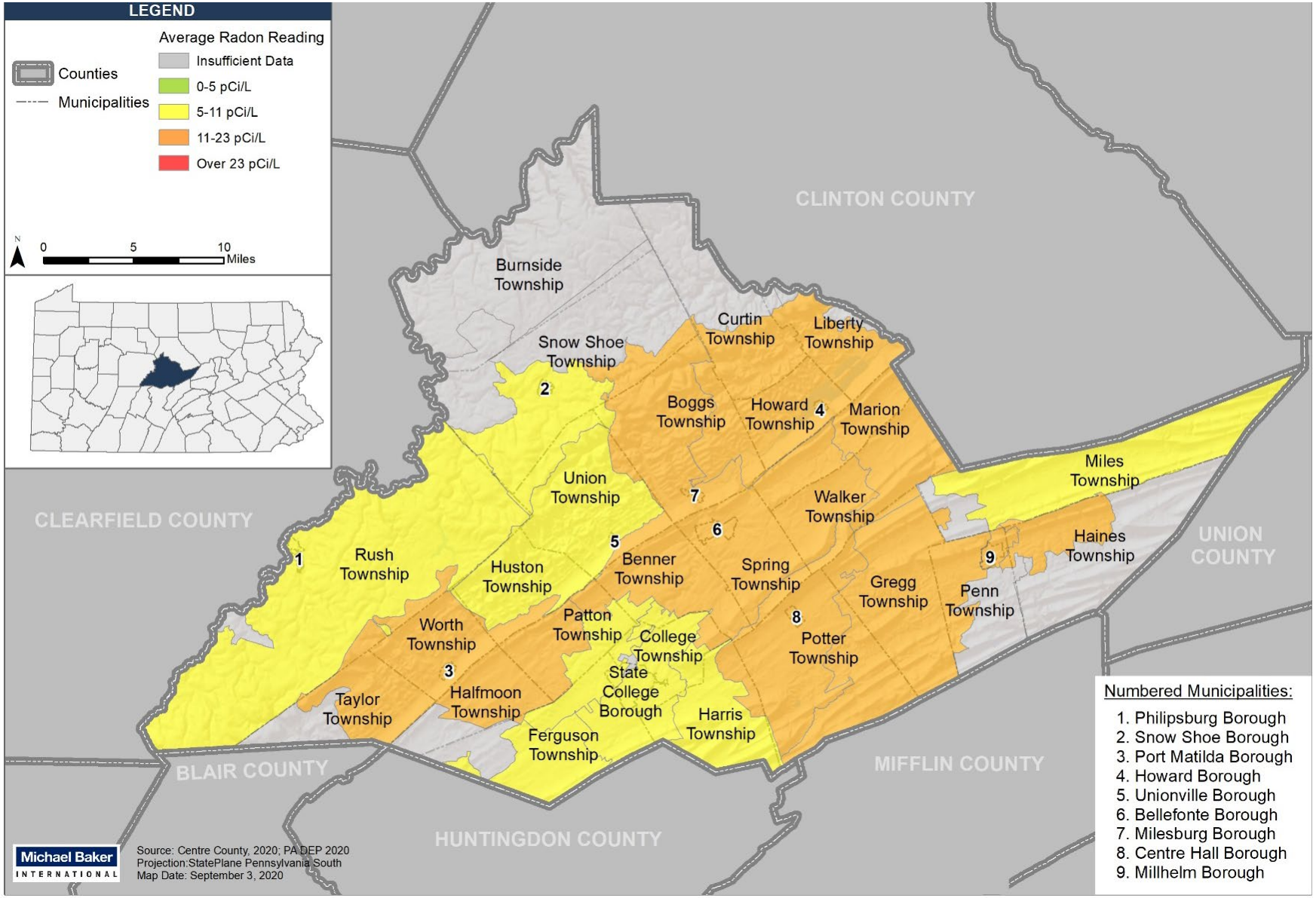


Figure 4.3.8-4: Centre County Maximum Basement Radon Test Results, 2020

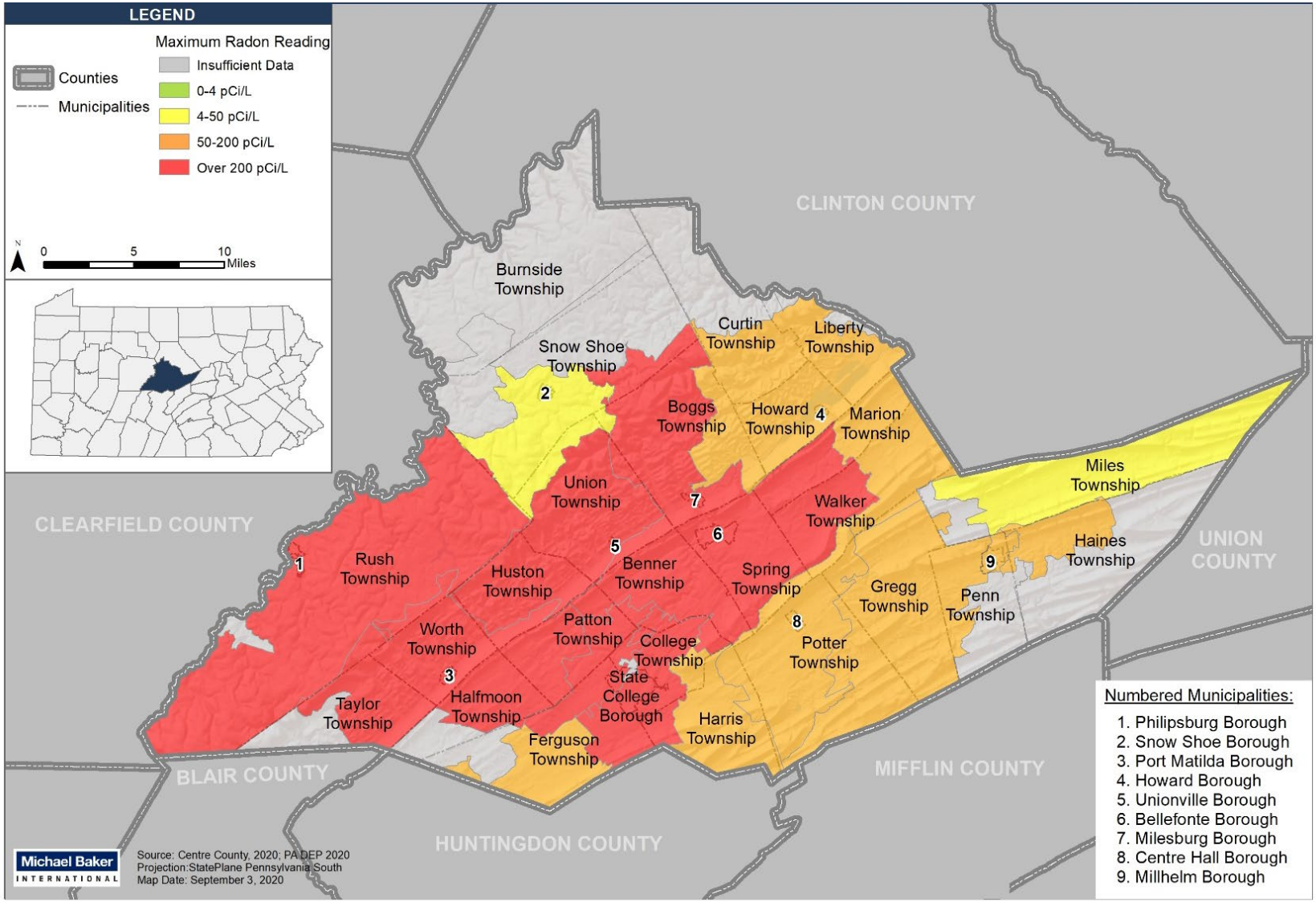


Figure 4.3.8-5: Centre County Average First Floor Radon Test Results, 2020

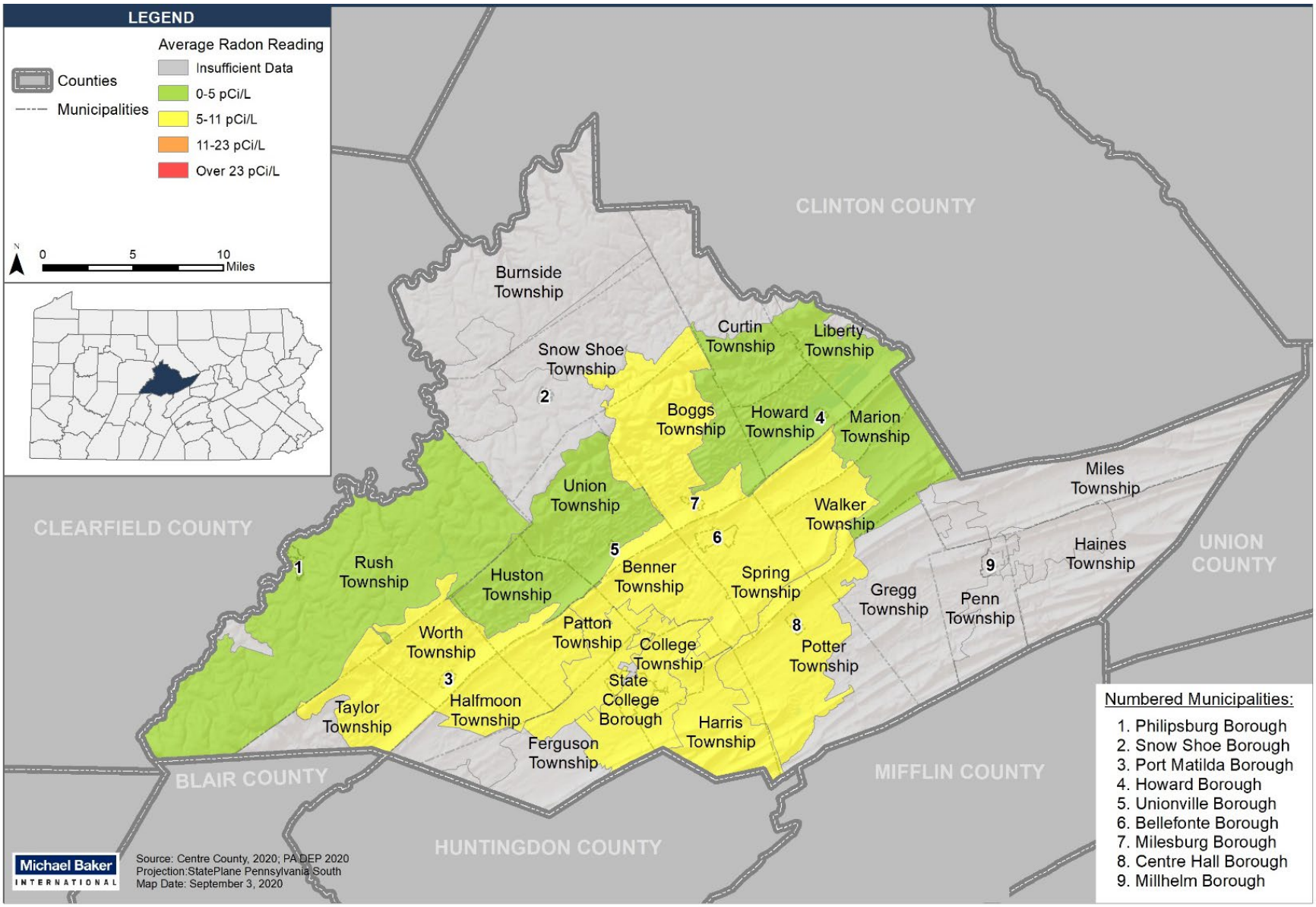
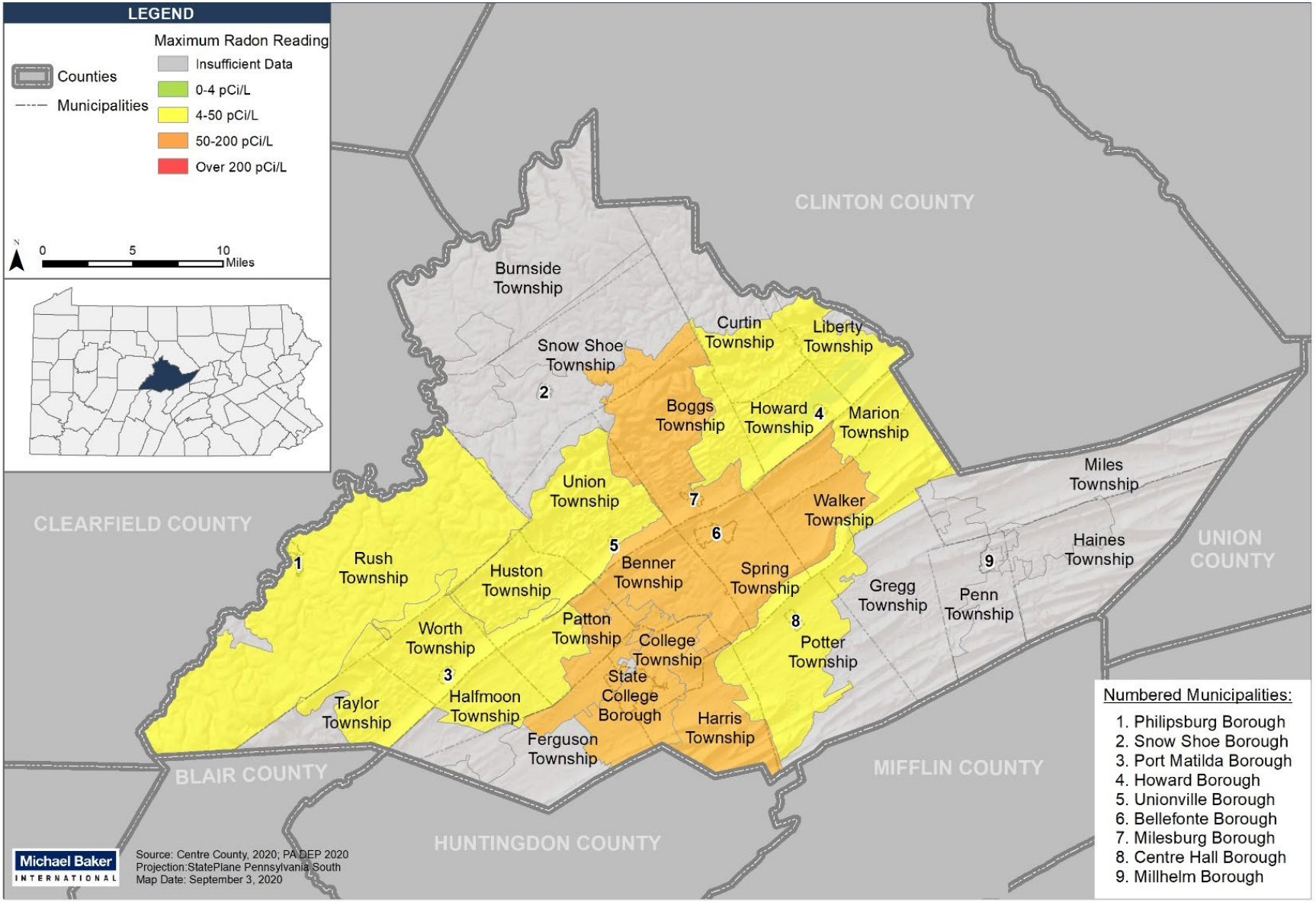


Figure 4.3.8-6: Centre County Maximum First Floor Radon Test Results, 2020



4.3.8.2 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 (US EPA, 2016). 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 4.3.8-1 shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As is shown in Table 4.3.8-1, a smoker exposed to radon has a much higher risk of lung cancer.

Table 4.3.8-1: Radon Risk for Smokers and Non-Smokers (US EPA, 2016)

RADON LEVEL (CCI/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	20 times the risk	

Table 4.3.8-1: Radon Risk for Smokers and Non-Smokers (US EPA, 2016)

RADON LEVEL (CCI/L)	IF 1,000 PEOPLE WERE EXPOSED TO THIS LEVEL OVER A LIFETIME…*	RISK OF CANCER FROM RADON EXPOSURE COMPARES TO…**	ACTION THRESHOLD
	get lung cancer	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
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.

4.3.8.3 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. Centre County is no 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 (PA DEP, 2019).

The PA DEP 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 Centre County, 20 zip codes had sufficient tests reported to the Bureau to list their findings, which are shown in Table 4.3.8-2. This table does not include the ZIP codes for which insufficient data was collected in both basements and first floors.

Table 4.3.8-2: Radon Level Tests and Results in Centre County Zip Codes (PA DEP, 2020b)

ZIP CODE	AREA OF CENTRE COUNTY	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)
16801	State College	10366	535.6	10	1138	56.5	6.8
16803	State College	5896	206	8.8	738	79.3	5.9
16805	State College	44	34.5	10.6	Insufficient Data		
16820	Aaronsburg	69	59.8	11.4	Insufficient Data		
16823	Bellefonte	3974	238.5	12.5	385	67.1	5.9
16826	Blanchard	40	12.8	3	Insufficient Data		
16827	Boalsburg	1269	159	10.5	204	64.6	6.2
16828	Centre Hall	471	102	13.2	37	27.6	5.9
16841	Howard	307	123	12.4	50	29.3	3.2
16844	Julian	179	256.6	10.5	31	13.4	3.7
16851	Lemont	331	45	7.9	Insufficient Data		
16853	Milesburg	41	17.5	5.2	Insufficient Data		
16854	Millheim	80	159	12.3	Insufficient Data		
16865	Pennsylvania Furnace	331	84.9	10.2	Insufficient Data		
16866	Philipsburg	486	504	9.5	76	25.9	3.1
16868	Pine Grove Mills	211	48.8	10	Insufficient Data		
16870	Port Matilda	1939	246.1	11.5	87	33.2	6.1
16872	Rebersburg	46	37.8	9.1	Insufficient Data		
16874	Snow Shoe	50	35.2	8.2	Insufficient Data		
16875	Spring Mills	308	194.8	15	Insufficient Data		

4.3.8.4 Future Occurrence

Radon exposure retains a significant probability given present soil, geologic, and geomorphic factors in Centre 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.

4.3.8.5 Vulnerability Assessment

Structures in Centre County, particularly in high vulnerability areas as shown in Figures 4.3.8-3 and 4.3.8-4, 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. 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.

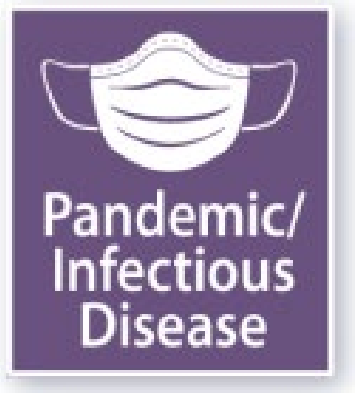
Proper testing for radon levels should be completed throughout Centre County, especially in the areas of higher incidence levels and for vulnerable populations that face the contributing risks described above. This testing will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools.

The 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 rest 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, Centre County has 51,853 buildings in areas with high radon test results, while approximately 20 percent, or 10,371, of these buildings will be impacted. The estimated costs for radon mitigation totaled $12,444,720.

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.

Figure 4.3.8-7: Radon Mitigation Systems (Scott Home Inspection, 2017) (IRadon, 2020)

4.3.9 Pandemic and Infectious Disease



4.3.9.1 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 where there are large concentrations of people. The transmission rate of infectious disease will depend on the mode of transmission of a given illness. Pandemic events can also occur after other natural disasters, particularly floods, when there is the potential for bacteria to grow and contaminate water.

Centre County is primarily concerned with the possibility of a pandemic flu outbreak. 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 healthy individuals, and easily transmittable from person-to-person.

Different strands of influenza mutate over time and replace older stands 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 then on to people. This virus has killed more than half of the people infected with it, although the avian flu is less likely to infect humans.

Meningitis is also a concern in Centre County because of the large student population at Penn State University. Meningitis is caused by the inflammation of the membranes that protect the brain and spinal cord. Meningitis usually typical develops as result of bacterial or viral infections, although it can also be caused by cancer, certain drugs, and physical injuries. Bacterial meningitis is contagious and can be spread through respiration secretions (expelled when a person coughs, sneezes, talks, or laughs) and throat secretions. Viral meningitis on the other hand is much less likely to be spread through these means; however, close contact with a person who has viral meningitis can cause an individual to become infected with the virus that caused the meningitis. Fungal meningitis is caused by fungi and is usually acquired by inhaling fungal spores, although it is not contagious.

During this HMP Update process, a novel coronavirus spread into a worldwide pandemic. 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, in addition to so little being known about it. 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, people should remain six feet apart to slow the spread of transmission.

4.3.9.2 Range of Magnitude

The magnitude of a pandemic or infectious disease threat in Centre 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, limiting 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 4.3.9-2). The severity of illness from the 2009 H1N1 influenza flu virus varied, with the gravest cases occurring mainly among those considered at high risk. High-risk populations 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 4.3.9.5. Most people infected with swine flu in 2009 recovered without needing medical treatment (CDC, 2009b). Unlike a regular flu season, according to the Centers for Disease Control (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, it is recorded that 8,000 Pennsylvanians died from the flu or its complications

in the first month alone (US DHHS, 2009). Infection rates were much worse in denser cities, which should be a high priority for response actions in future flu events.

An estimate of potential impacts was prepared for the Penn State University Pandemic Response Plan, based upon an influenza pandemic strain three times more lethal than the 1968 pandemic (see Table 4.3.9-1). This is assumed as the worst-case scenario, involving a virus that occurs in a dense campus setting, is easily transmitted between humans, and extremely deadly.

Table 4.3.9-1: Projections of Severe Influenza Impact (Penn State University Pandemic Response Plan)

	POPULATION	LOW SEVERITY	MODERATE SEVERITY	HIGH SEVERITY
Pennsylvania	12,406,292			
Cases		3,004,915	3,004,915	3,004,915
Hospitalizations		37,553	112,658	225,318
Deaths		9,062	27,185	54,369
Centre County	140,476			
Cases		35,119	35,119	35,119
Hospitalizations		421	1,264	2,529
Deaths		102	309	818
Penn State Uni.	42,000			
Cases		10,500	10,500	10,500
Hospitalizations		126	378	750
Deaths		30	92	185

Avian bird flu hit 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 Centre County.

Bacterial meningitis is usually severe. In the United States, roughly 4,100 cases of bacterial meningitis occurred each year between 2003 and 2007. Of these 4,100 cases, approximately 500 resulted in death (CDC, 2015a). Certain factors can increase risk to bacterial meningitis, including age and certain medical conditions. Similarly, an outbreak of bacterial meningitis on Penn State's campus that resulted in fatalities would be a worst-case scenario for Centre County.

Centre 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 like 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 Spring and Summer 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 attempt to slow the transmission of COVID-19. State health officials note

that the virus has infected all age ranges at about the same rate, and that no age group can be considered more or less vulnerable to infection. After Penn State University students returned to campus in late August 2020, cases quickly rose in Centre County again. This prompted the Pennsylvania Department of Health to open a free pop-up testing site.

4.3.9.3 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 4.3.9-2.

Table 4.3.9-2: 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 of 1968 with deaths peaking between December 1968 and January 1969 (Global Security, 2009).

In the 2009/2010 season, when H1N1 was a primary concern, there were 378 confirmed flu cases in Centre County, one of the highest amounts of reported cases in a county in Pennsylvania. According to the Pennsylvania Department of Health (PA DOH), the most recent intense influenza season, the 2012/2013 season which began earlier than most flu seasons, there were 826 confirmed flu cases in Centre County (PA DOH, 2014). Table 4.3.9-3 lists the number of seasonal flu cases in Centre County from the 2014/2015 flu season.

Table 4.3.9-3: Number of Flu Cases in Centre County by Flu Season (PA DOH, 2020a)

FLU SEASON	# OF CASES
2014/2015	786
2015/2016	547
2016/2017	988
2017/2018	2237
2018/2019	1854

An avian flu outbreak in Pennsylvania occurred in 1983 through1984, 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).

In 2012, there was a multi-state outbreak of fungal meningitis among patients who received contaminated preservation-free steroid injections from a medical facility in Massachusetts. There have been numerous meningitis outbreaks on college campuses in recent years: eight students were infected with bacterial meningitis at Princeton University in 2013 and 20 cases of viral meningitis were reported at the University of Maryland. Additionally, one San Diego University student died after diagnosed with bacterial meningitis in 2014.

The COVID-19 outbreak began in China in November 2019. The virus reached the United States in late February 2020, and most counties in Pennsylvania were affected by March 2020. By October 1, 2020, there were more than 162,140 confirmed cases in Pennsylvania, with almost 3,000 cases and 12 deaths reported in Centre County (PA DOH, 2020b). County sources note that case numbers quickly rose as college students came back to the Penn State University main campus in late August. Nearly 2,300 cases were reported in September 2020. The new cases totaled about two and half times more than the total cases from March through August combined. As shown in Table 4.3.9-4, the number of cases continues to rise at a steady rate.

Table 4.3.9-4: Cumulative COVID-19 Cases and Total Deaths in Centre County (PA DOH, 2020b)

DATE	CUMULATIVE CASES	TOTAL DEATHS
March 31, 2020	36	0
April 30, 2020	105	1
May 31, 2020	160	6
June 30, 2020	211	8
July 31, 2020	361	10
August 31, 2020	509	11
September 30, 2020	2,847	12
October 31, 2020	4,271	22
November 30, 2020	6,407	85
December 31, 2020	9,096	155
January 31, 2021	11,429	198

This upsurge in Fall 2020 led the PA DOH to open a free COVID testing site at Nittany Mall, which can test up to 500 individuals for free each day regardless of signs of symptoms (Rushton, 2020). The test site is being funded through CARES Act funds received by the County. Case numbers were expected to continue to peak in May 2020, however, the Commonwealth is still experiencing challenges with the COVID pandemic. While those who tested positive are

isolating in their homes, county officials urge the entire population to isolate and act as if the virus is everywhere.

4.3.9.4 Future Occurrence

Future occurrences of pandemics and infectious diseases are unclear. The precise timing of pandemic influenza is 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 emergency response plans.

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

4.3.9.5 Vulnerability Assessment

Schools and major universities are particularly vulnerable to the spread of disease due to the presence of large population groups in relatively close confinement. While Penn State University is particularly vulnerable to influenza and meningitis, in response to a previous avian flu (H5N1) outbreak, the University has adopted a Pandemic Response Plan. The plan recognizes that preparedness for one particular strain of influenza will also benefit in preparation for future pandemic influenza strains or another sort of public health disaster such as SARS, smallpox, or anthrax.

At Penn State University, the planning for pandemic influenza occurs within the context of University-wide emergency planning and preparedness. Each administrative unit and academic department will respond to an infectious disease pandemic initially as they would to any emergency – with a concern for protection of human life and safety first and then for continuity of University operations, including continuity of instruction, research and graduate education. To the extent possible, the response should be guided by carefully planned procedures and protocols, recognizing that any emergency will also demand flexibility and agility in a rapidly evolving situation. Response actions include the suspension of classes and quarantine of students as needed. These actions were used in March 2020 in response to the COVID-19 outbreak.

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, 2015b). 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. All communities in Centre County are considered vulnerable to a pandemic event, with the likely greatest impact in terms of population affected and disruption of economic activity occurring at the Penn State University campus in State College Borough and surrounding College Township. 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 loss due to lost productivity and medical expenses (Saunders-Hastings & Krewski, 2016). With Pennsylvania's economy so 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 Centre County. According to the 2017 Agricultural census, livestock sales make up about two-thirds of Centre County's agricultural sales. Poultry and egg sales totaled around $3,038,000 in 2017.

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. There is specific concern for those who worked in service and hospitality industries. Construction projects and other businesses are in limbo, while many others decide to permanently close. However, the commonwealth and the federal government are releasing relief packages for individuals and businesses. It is currently unknown how COVID-19 will change the economic environment.

Figure 4.3.9-3: COVID Test Site Opens in Centre County (Parish, 2020)

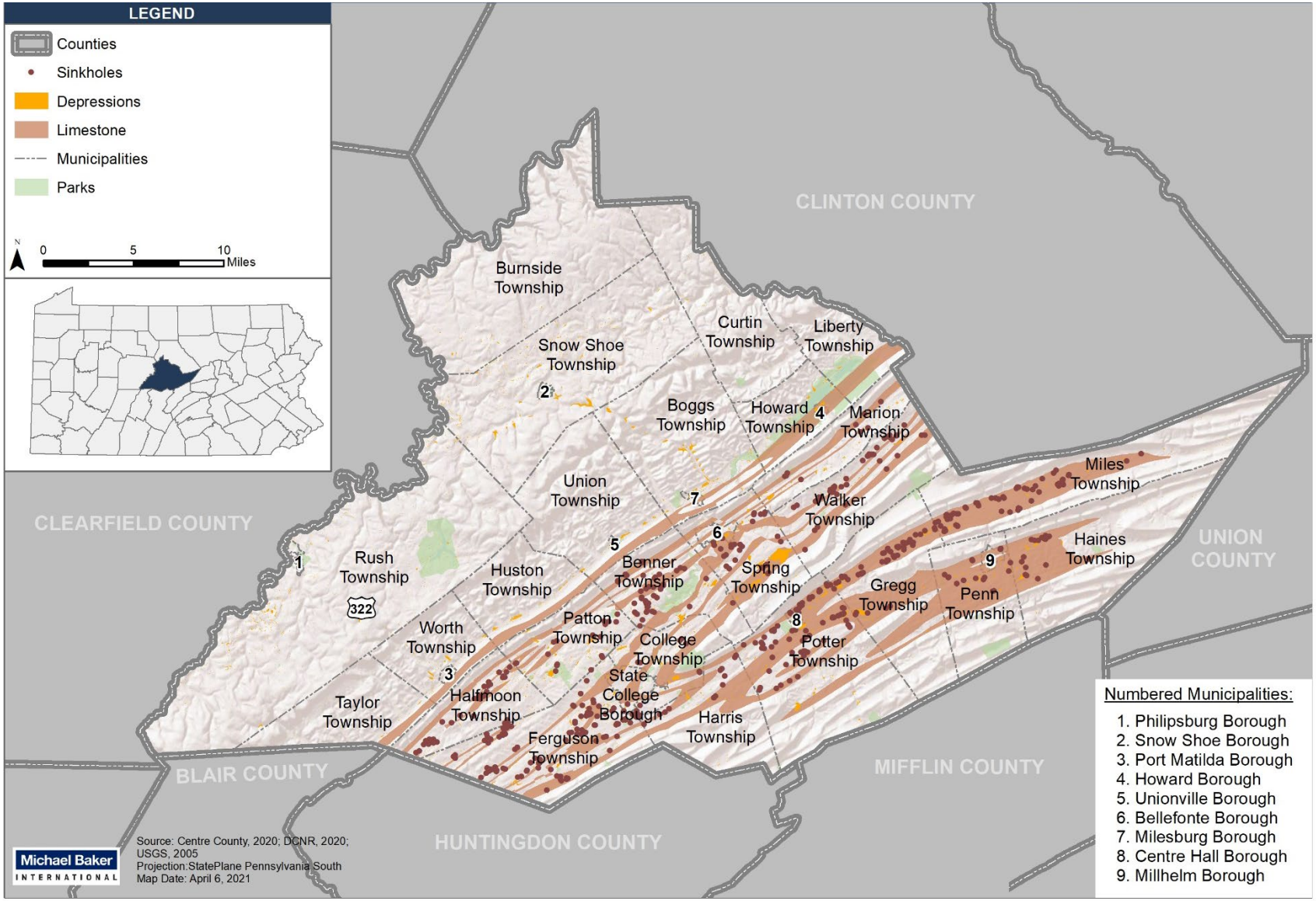
4.3.10 Subsidence, Sinkhole

4.3.10.1 Location and Extent

Subsidence is the gradual or sudden caving in or sinking of land. Subsidence is caused by geological factors; human actions can exacerbate the natural causes of subsidence to increase the likelihood of an event occurrence. Much of the County is made up of limestone valleys susceptible to sinkholes, also known as karst topography. Natural subsidence results from water movement through a limestone terrain causing swales or sinkholes. Water passing through naturally occurring fractures and bedding planes dissolve the limestone bedrock leaving voids below the surface. Eventually, overburden on top of the voids collapse, leaving sinkholes, surface depressions, and caves. Often, sub-surface solution of limestone will not result in the immediate formation of karst features. Collapse sometimes occurs only after a large amount of activity, or when a heavy burden is placed on the overlying material. Abrupt or long-term changes in the ground surface may also occur following sub-surface fluid extraction (e.g. natural gas, water, oil, etc.). Figure 4.3.10-1 shows that much of Centre County lies in an area of Pennsylvania where limestone is present near ground surface, thus making it most susceptible to natural sinkhole development. The USGS dataset from 2005 showing limestone location is the most recent, comprehensive, and publicly available source. These conditions are anticipated to be consistent in 2020 as changes to geological features occur over a significantly greater timespan. The map also includes known sinkhole and surface depression locations and larger towns and cities that are adjacent to these areas.

Centre County has a history of subsidence due to natural conditions and past mining activities. Areas underlain by coal or other minerals which use deep mining techniques may become susceptible to subsidence. There has been no accurate mapping of past underground mining, making it difficult to predict where mine-related subsidence might occur. Sinkholes are most likely to form following high run-off periods in the spring and fall seasons. Broken water lines and ruptured underground water tanks can also create the conditions for sinkhole occurrences. Sinkholes of varying sizes have been reported in many areas of Centre County's large limestone valleys, including residential areas outside State College and in the Philipsburg area, where a collapsed home was reported in 1974.

Figure 4.3.10-1: Areas Susceptible to Subsidence in Centre County, 2020



4.3.10.2 Range of Magnitude

Based on the geologic formations underlying much of Centre County, subsidence and sinkhole events may occur gradually or abruptly. Events could result in minor elevation changes or deep, gaping holes in the ground surface. Subsidence and sinkhole events can cause severe damage in urban environments, although gradual events can be addressed before significant damage occurs. If long-term subsidence or sinkhole formation is not recognized and mitigation measures are not implemented, fractures or complete collapse of building foundations and roadways may result. In 2001, the worst-case sinkhole event occurred when there was a mine roof collapse at a Spring Township limestone mine that required a search and rescue team response.

4.3.10.3 Past Occurrence

Centre County does not have a record of a significant subsidence-based disaster. PA DCNR's online sinkhole database lists 546 sinkholes identified across the County since 1985. Some of these sinkholes have been filled. Table 4.3.10-1 shows the number of sinkholes per municipality recorded in this inventory.

Table 4.3.10-1: Number of Sinkholes per Municipality in Centre County (DCNR, 2020b)

MUNICIPALITY	NUMBER OF SINKHOLES
Benner Township	46
Centre Hall Borough	3
College Township	11
Ferguson Township	110
Gregg Township	48
Haines Township	19
Halfmoon Township	43
Harris Township	17
Marion Township	9
Miles Township	58
Millheim Borough	2
Patton Township	19
Penn Township	13
Potter Township	70
Spring Township	30
State College Borough	1
Walker Township	47
Total	**546**

Sinkholes are typically reported to municipal or county officials as necessary when they impact public infrastructure. Sinkholes occurring on private property are often not reported, especially when they do not affect any existing structures.

In July 2015, a sinkhole opened in a suburban neighborhood in Ferguson Township. The sinkhole, which was approximately 20 feet wide, 20 feet long, and 15 feet deep, is shown in Figure 4.3.10-2. A sinkhole appeared on Penn State's campus in July 2015 as well on Bigler Road next to the Millennium Science Complex. As a result, the roadway was closed and all CATA buses were rerouted. This sinkhole, which is shown in Figure 4.3.10-3, was roughly 20 feet long, 15 feet wide, and 5 feet deep.

Figure 4.3.10-2: Sinkhole Closes Road in Ferguson Township (Murach, July 2015a)

Figure 4.3.10-3: Sinkhole on Bigler Road on Penn State's campus (Murach, July 2015b)

Stakeholders in the 2015 planning process also identified additional occurrences of subsidence throughout Centre County including:

- On Purdue Mountain, a bank next to T-383 is subsiding.
- There are currently six known active sinkholes and over 50 outfalls in State College Borough.
- There are numerous sinkholes across Penn State University's campus.
- There are sinkholes, mostly on private property, in Marion Township.

Since 2015, multiple jurisdictions have reported an increase in the frequency, impact, and extent of subsidence and sinkholes. Communities with the highest number of these events are Ferguson, Miles, and Potter Townships. Past mining activities in the county contribute to risk of subsidence. In June 2018, a sinkhole was reported to the Centre County Office of Emergency Services. Heavy rain caused a sinkhole to open on SR-26 in College Township. In July 2018, a sinkhole opened on a residential street in Ferguson Township. The sinkhole, shown in Figure 4.3.10-4, was approximately 20 feet long, 20 feet wide, and 13 feet deep, and ruptured a water line.

Figure 4.3.10-4: Workers repair sinkhole in Ferguson Township (Muthler & Hartley, 2018)

4.3.10.4 Future Occurrence

Based on geological conditions and the presence of previously formed sinkholes, subsidence events are likely to occur in the future for the areas of Centre County underlain by carbonate

rock. Additionally, as noted in Section 4.3.4, Centre County anticipates an increase in the frequency and magnitude of flood events as a result of increasing amounts and intensity of precipitation. Increased rainfall has also been shown to increase occurrences of land subsidence and sinkholes. Therefore, recurrence of sinkholes is probable in the future, and repairs will need to be initiated, especially to protect nearby structures or other features. Most repairs include excavation of the sinkhole "throat", placement of durable materials (such as rip-rap) in the sinkhole void, and mitigation of the conditions that led to the formation of the sinkhole (such as stormwater discharges, broken pipes). Addressing these conditions can reduce future occurrences. Therefore, the future occurrence of subsidence can be considered *likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.10.5 Vulnerability Assessment

Sinkholes can appear very suddenly and without warning and can continue to grow after the initial collapse making the surrounding ground unstable. Sinkholes on roadways are a danger to drivers, and those around gas lines can result in leaks or explosions if left undetected. Sinkholes cause structural damage and instability in homes, commercial buildings, roads, and bridges. As a natural characteristics of karst watersheds, the presence of high flow-rate springs (such as near Pleasant Gap, Spring Township) heighten the potential vulnerability to contamination from improper chemical or waste management.

The valley portions of the County are most vulnerable to the effects of natural subsidence events. Local roads may need annual repair and damage to gas lines, telephone, and electrical entry road facilities could occur in highly populated areas. Based on historical events, Ferguson, Potter, and Miles Townships are most vulnerable to sinkhole events. These municipalities have the highest occurrences of sinkholes. However, there are ten other municipalities in Centre County reporting ten or more sinkhole events, and a total of 17 communities have had reported sinkhole events (see Table 4.3.10-1).

The vulnerability of individual structures and critical facilities (excluding oil and gas wells) to subsidence and sinkhole events depends on underground site conditions related to the presence of limestone at each location. Table 4.3.10-2 details the structures and critical facilities which are placed in subsidence areas distinguished by the presence of limestone by municipality. The municipalities with the most structures vulnerable to subsidence are State College Borough (3,321), Spring Township (1,954), and Ferguson Township (1,943), while communities with the highest percentage of structures located on karst topography are Howard Borough (100 percent), Millheim Borough (90 percent), and Miles Township (67 percent). In Centre County, there are no conventional or unconventional oil or gas wells are located on Karst Topography. Critical facilities located on karst topography primarily include dams, day care centers, schools, and water and sewer treatment plants. Dams and water and sewer treatment plants on karst topography may involve flood risk as a result of subsidence or sinkhole events. Table 4.3.10-3 shows subsidence vulnerability by structure type. The most vulnerable land use types in Centre County are residential (15,663), commercial (690), and public structures (463). Mines (21), utility (64), and industrial (90) were among the least vulnerable; this is likely as there are far fewer of these facilities than residential and commercial structures in the County.

Table 4.3.10-2: Structures and Critical Facilities Vulnerable to Subsidence

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON KARST TOPO-GRAPHY	PERCENT STRUCTURES ON KARST TOPO-GRAPHY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON KARST TOPO-GRAPHY	PERCENT CRITICAL FACILITIES ON KARST TOPO-GRAPHY
Bellefonte Borough	2,658	942	35%	17	9	53%
Benner Township	2,369	832	35%	26	10	38%
Boggs Township	1,598	253	16%	9	1	11%
Burnside Township	441	0	0%	3	0	0%
Centre Hall Borough	579	399	69%	4	0	0%
College Township	4,810	1,872	39%	44	16	36%
Curtin Township	448	0	0%	2	0	0%
Ferguson Township	6,949	1,943	28%	27	9	33%
Gregg Township	1,179	681	58%	10	8	80%
Haines Township	1,003	548	55%	7	4	57%
Halfmoon Township	1,089	327	30%	5	0	0%
Harris Township	2,798	1,401	50%	8	3	38%
Howard Borough	298	298	100%	4	4	100%
Howard Township	523	171	33%	1	1	100%
Huston Township	684	16	2%	1	0	0%
Liberty Township	1,233	151	12%	5	1	20%
Marion Township	501	155	31%	3	0	0%
Miles Township	944	633	67%	15	11	73%
Milesburg Borough	475	157	33%	3	1	67%
Millheim Borough	427	383	90%	4	2	50%
Patton Township	5,315	401	8%	22	2	9%
Penn Township	881	447	51%	15	12	80%
Philipsburg Borough	1,309	0	0%	9	0	0%

Table 4.3.10-2: Structures and Critical Facilities Vulnerable to Subsidence

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON KARST TOPO-GRAPHY	PERCENT STRUCTURES ON KARST TOPO-GRAPHY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON KARST TOPO-GRAPHY	PERCENT CRITICAL FACILITIES ON KARST TOPO-GRAPHY
Port Matilda Borough	256	15	6%	4	0	0%
Potter Township	2,015	939	47%	15	8	53%
Rush Township	2,462	0	0%	26	0	0%
Snow Shoe Borough	346	0	0%	2	0	0%
Snow Shoe Township	1,347	0	0%	8	0	0%
Spring Township	3,654	1,954	53%	19	9	47%
State College Borough	6,861	3,321	48%	36	15	42%
Taylor Township	497	5	1%	1	0	0%
Union Township	775	9	1%	5	0	0%
Unionville Borough	134	0	0%	0	0	0%
Walker Township	2,038	782	38%	13	7	54%
Worth Township	471	18	4%	2	1	50%
Total	**59,367**	**19,053**	**32%**	**375**	**134**	**36%**

Table 4.3.10-3: Structures Vulnerable to Subsidence by Municipality and Land Use Type in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	Agriculture	Commercial	Communications	Forests	Industrial	Mined Land	Mixed Use	Public or Semi-Public	Reclaimed Land	Recreation	Residential	Transportation	Utility	Vacant and Unused Land	Vacant Structure	Water	Total
Bellefonte Borough	2,658	0	40	0	0	6	0	142	39	0	2	666	33	2	8	4	0	942
Benner Township	2,369	36	56	0	5	8	2	3	8	0	0	636	22	2	54	0	0	832
Boggs Township	1,598	5	16	0	4	1	0	6	0	0	1	218	2	0	0	0	0	253
Burnside Township	441	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centre Hall Borough	579	0	15	0	0	4	0	33	29	0	0	312	2	0	2	2	0	399
College Township	4,810	80	95	1	16	13	1	0	139	0	32	1,332	48	14	99	2	0	1,872
Curtin Township	448	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ferguson Township	6,949	31	91	0	14	11	0	0	15	0	4	1,705	29	2	40	0	1	1,943
Gregg Township	1,179	22	18	1	0	3	0	34	23	0	7	545	25	1	2	0	0	681
Haines Township	1,003	10	22	0	4	1	2	11	14	0	5	467	4	0	5	3	0	548
Halfmoon Township	1,089	7	3	0	3	0	0	0	3	0	1	298	0	0	11	1	0	327
Harris Township	2,798	12	15	0	17	6	0	0	4	0	12	1,083	41	1	210	0	0	1,401
Howard Borough	298	1	4	1	0	0	0	8	9	0	3	267	0	0	2	3	0	298
Howard Township	523	10	2	0	2	0	0	1	1	0	35	118	0	2	0	0	0	171
Huston Township	684	0	4	1	0	0	0	0	0	0	1	6	4	0	0	0	0	16
Liberty Township	1,233	2	0	0	3	0	0	4	0	0	35	102	0	3	1	1	0	151
Marion Township	501	7	5	3	4	1	0	1	7	0	3	120	0	0	4	0	0	155
Miles Township	944	28	22	0	1	5	0	14	19	0	2	519	20	0	3	0	0	633
Milesburg Borough	475	0	6	0	0	0	0	16	6	0	0	124	1	2	0	2	0	157
Millheim Borough	427	1	20	0	0	1	0	31	9	0	3	306	2	1	6	3	0	383

Table 4.3.10-3: Structures Vulnerable to Subsidence by Municipality and Land Use Type in Centre County, 2020

MUNICIPALITY	TOTAL STRUCTURES	Agriculture	Commercial	Communications	Forests	Industrial	Mined Land	Mixed Use	Public or Semi-Public	Reclaimed Land	Recreation	Residential	Transportation	Utility	Vacant and Unused Land	Vacant Structure	Water	Total
Patton Township	5,315	3	4	0	10	0	0	0	2	0	0	357	18	0	7	0	0	401
Penn Township	881	18	15	0	1	0	0	8	11	0	4	381	5	2	2	0	0	447
Philipsburg Borough	1,309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port Matilda Borough	256	0	0	0	0	0	0	0	0	0	0	14	0	1	0	0	0	15
Potter Township	2,015	19	47	1	9	2	0	28	21	0	6	742	20	3	39	2	0	939
Rush Township	2,462	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snow Shoe Borough	346	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snow Shoe Township	1,347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spring Township	3,654	12	52	5	16	27	16	24	18	0	4	1,616	7	15	137	5	0	1,954
State College Borough	6,861	0	109	3	11	0	0	47	81	0	17	3,011	28	8	5	0	1	3,321
Taylor Township	497	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	5
Union Township	775	0	0	0	1	0	0	0	0	0	0	8	0	0	0	0	0	9
Unionville Borough	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walker Township	2,038	13	29	4	3	1	0	6	5	0	1	699	0	3	18	0	0	782
Worth Township	471	0	0	0	1	0	0	0	0	0	0	11	4	2	0	0	0	18
Total	**59,367**	**317**	**690**	**20**	**125**	**90**	**21**	**417**	**463**	**0**	**178**	**15,663**	**319**	**64**	**656**	**28**	**2**	**19,053**

4.3.11 Tornado, Windstorm

4.3.11.1 Location and Extent

Tornadoes and potentially damaging high winds occur throughout Pennsylvania. Tornados and high winds can be experienced at any location in Centre County.

A tornado, a violently rotating funnel-like vortex, is an extraordinary feature of severe thunderstorms. A condensation funnel does not need to reach to the ground for a tornado to be present; a debris cloud beneath a thunderstorm is all that is needed to confirm the presence of a tornado, even in the total absence of a funnel. While the extent of tornado damage is usually localized, the extreme winds of this vortex can be among the most destructive on earth when they move through populated, developed areas.

Tornadoes can occur at any time during the day or night but are most frequent during late afternoon into early evening, the warmest hours of the day. May to August is the most likely time for tornados to occur in Pennsylvania. Tornado movement is characterized in two ways: direction and speed of spinning winds and forward movement of the tornado, also known as the storm track. Rotational wind speeds of the vortex can range from 100 mph to more than 250 mph. In addition, the speed of forward motion can be zero to 45 or 50 mph. Therefore, some estimates place the maximum velocity (combination of ground speed, wind speed, and upper winds) of tornadoes at about 300 mph.

The forward motion of the tornado path can be a few hundred yards or several hundred miles in length. The width of tornadoes can vary greatly, but generally range in size from less than 100 feet to over a mile in width. Some tornadoes never touch the ground and are short-lived, while others may touch the ground several times.

Straight-line winds often accompany tornados and are caused by the movement of air from areas of higher pressure to areas of lower pressure – the greater the difference in pressure, the stronger the winds. Windstorms are generally defined as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.

4.3.11.2 Range of Magnitude

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as mobile homes. The impact of tornado hazards is ultimately dependent on the population or amount of property present in the area in which the tornado occurs. Tornado events are often so severe that property loss or human fatality is typically inevitable if evacuation or proper construction standards are not implemented.

Since 2007, enhanced Fujita Tornado Scale (or the –EF-Scale) has been used in the United States to describe the magnitude of tornadoes. Prior to 2007, the Fujita Scale (F-Scale) was commonly used to describe magnitude. This scale is based on new information about the relationship between wind speed given in miles per hour (mph) and corresponding damages. The EF Scale categorized tornadoes from EF0 to EF5 with EF0 being the most commonly occurring type of tornado. The strongest tornado recorded in Centre County was a category F4. Table 4.3.11-1 shows the relationship between the EF- and F- Scales. The types of damages that can be expected with each category of tornado are described in Table 4.3.11-2.

Table 4.3.11-1: Enhanced Fujita Scale (EF-Scale) categories with associated wind speeds

FUJITA SCALE		ENHANCE FUJITA SCALE	
F NUMBER	3-SECOND GUST (MPH)	EF NUMBER	3-SECOND GUST (MPH)
0	45-78	0	65-85
1	79-117	1	86-110
2	118-161	2	111-135
3	162-209	3	136-165
4	210-261	4	166-200
5	262-317	5	OVER 200

Table 4.3.11-2: Expected Tornado Damages

F OR EF SCALE	EXAMPLES OF POSSIBLE DAMAGE
0	Light damage. Some damage to chimneys; broken tree branches; shallow-rooted trees pushed over; damage to sign boards.
1	Moderate damage. Surface peeled off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
2	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

3	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
4	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
5	Catastrophic damage. Well-built houses swept completely away, leaving only the slab foundations.

Figure 4.3.5-1 shows wind speed zones developed by the American Society of Civil Engineers based on information including 40 years of tornado history and over 100 years of hurricane history. 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. Centre County falls in Zone III, meaning the whole County is susceptible to winds up to 200 miles per hour. The hurricane susceptibility shown in the map is discussed in Section 4.3.5. Shelters and critical facilities should be able to withstand a three second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. In Centre County, all new residential and commercial structures are required to be constructed per the International Building Code (IBC), which requires structures to be designed to a 90-mph wind speed.

Since tornado and windstorm events are typically localized, environmental impacts are rarely widespread. However, where these events occur, severe damage to buildings and plant species is likely. This includes loss of trees and an increased threat of wildfire in areas where dead trees are not removed. Hazardous material facilities should meet design requirements to withstand a three-second gust of up to 160 mph in order to prevent release of hazardous materials into the environment.

4.3.11.3 Past Occurrence

One of the deadliest tornadoes in Pennsylvania occurred during a tornado outbreak on May 31, 1985 when up to 42 tornados touched down in Pennsylvania, Ohio, New York, and southeastern Ontario. One storm, rated at EF5 (F4) intensity, tracked across the state forests of central Pennsylvania during the early evening producing tornadic winds of 200-250 mph. The tornado started four miles west-southwest of Penfield in northwest Clearfield County, it moved into Clinton County and eventually passed over the extreme northern tip of Centre County, in Burnside Township, before reentering Clinton County and finally ending seven miles northeast of downtown Lock Haven (just north of the Centre County border). Officials estimated that 85,000 to 90,000 trees were leveled across this track. Photos of the damage this tornado caused to trees in Parker Dam State Forest in Clearfield County are shown in Figures 4.3.11-1 and 4.3.11-2. Additionally, a photo of a funnel cloud in Cherry Tree in Indiana County from this same day is shown in Figure 4.3.11-3.

The worst-case scenario for tornado events in Centre County could be exemplified by this tornado outbreak in 1985. In this case, the EF5 (F4) tornado occurred mostly in adjacent counties. Little to no damages were reported in Centre County. However, had the path been different, the following damage could be anticipated for Centre County as well. In total, this event destroyed 13 houses, a large steel fire tower, and many miles of state forest (estimated at 85,000 - 90,000). Major population centers were missed, sparing many lives. The tornado was estimated to remain on the ground more than one hour and 25 minutes and covered a path of about 70 miles.

The HMSC recognizes that this type of tornado is extremely rare and that this event would represent a worst-case scenario only. More typical wind hazard events in Centre County involve tree and limb damage, with barn roof damage typically sustained as these represent some of the oldest and most susceptible structures.

A list of tornado events that have occurred in Centre County between 1950 and 2020 is shown in Table 4.3.11-3 with an associated F-Scale magnitude. Figure 4.3.11-4 also shows the approximate location of previous events from 1975 to 2020 that had center of circulation located in or tracked through Centre County

In April 2015, the County experienced a tornado due to a violent series of storms that passed through the State College area. Officials from NWS confirmed that a tornado touched down near Colyer Lake, passing through areas of Church Road in Potter Township and then traveling northeast. The tornado was reported to have had maximum winds of 65 mph and width of 40 yards wide and remained on the ground for about one mile. Residents impacted by the tornado experienced minimal property damage from the event (Bauer, 2015).

Figure 4.3.11-1: Damage in Parker Dam State Forest from the May 31, 1985 Tornado Outbreak (AccuWeather, 2010)

Figure 4.3.11-2: Damage in Parker Dam State Forest from the May 31, 1985 Tornado Outbreak (AccuWeather, 2010)

Figure 4.3.11-3: Funnel Cloud in Cherry Tree (Indiana County), One of the May 31, 1985 Tornados (US Tornadoes, 2015)

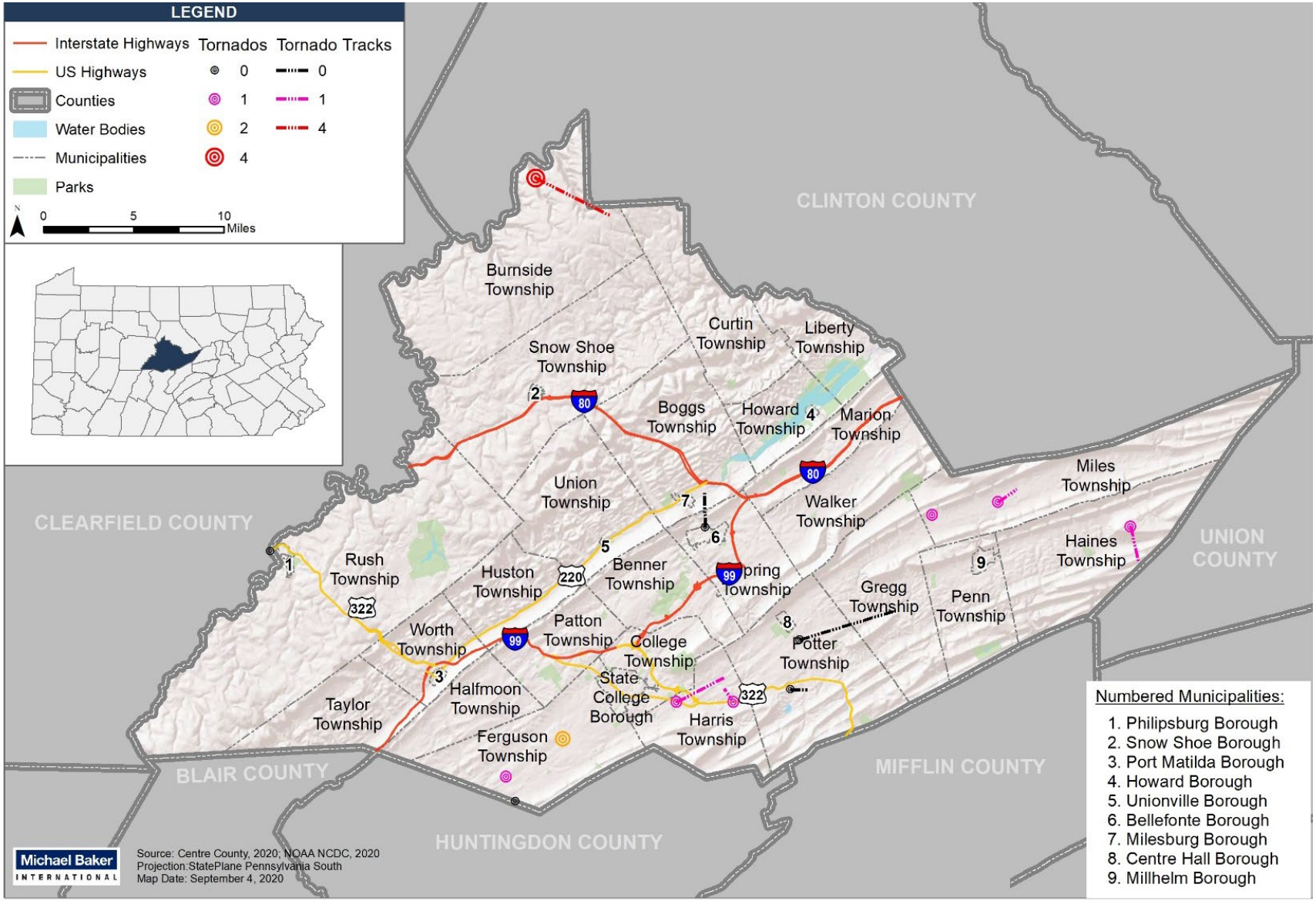
On May 1, 2017, a strong storm with high winds and possibly multiple tornados impacted Centre County. NWS determines at least one tornado touched down in Rebersburg. The storm knocked out power for over tens of thousands of County residents. Residents noted unusual strong winds that lasted for almost 10 to 15 minutes, which is much longer than is typically seen. This resulted in many trees being downed, as they were constantly being hit by the storm. The storm also came with flash flood events that caused road closures and downed power lines on roadways. One man was injured when the storm collapsed his garage while he was inside (Yoder, 2017).

Table 4.3.11-3: Previous Tornado Events in Centre County (NOAA NCEI, 2020a)

LOCATION	DATE	ESTIMATED LENGTH	ESTIMATED WIDTH	MAGNITUDE (F-SCALE)	ESTIMATED PROPERTY DAMAGE ($)
Countywide	6/5/1975	*not provided*	*not provided*	F2	250,000
Countywide	6/5/1975	*not provided*	*not provided*	F1	2,500
Countywide	7/29/1976	0.3 mile	40 yards	F1	250,000
Burnside	5/31/1985	4.5 miles	3330 yards	F4	25,000,000*
Countywide	2/16/1990	3.0 miles	350 yards	F1	250,000
Countywide	4/9/1991	0.5 miles	60 yards	F0	25,000
Spring Mills	11/8/1996	4.0 miles	550 yards	F0	100,000
Bellefonte	5/29/1998	2.0 miles	440 yards	F0	0
Philipsburg	6/2/1998	0.5 mile	67 yards	F0	0
Woodward	8/7/2007	2.0 miles	400 yards	EF1	0
Linden Hall	6/27/2013	1 mile	75 yards	EF1	0
Tusseyville	4/20/2015	0.96 miles	40 yards	EF0	5,000
Smullton	5/1/2017	1.1 miles	100 yards	EF1	200,000

* Reflects total damage from tornado track, only a small portion of which was in Centre County

Figure 4.3.11-4: Tornado History in Centre County, 1975-2020



High winds moving in a straight line are the movement of air from areas of higher pressure to areas of lower pressure. As the difference in pressure increases, the strength and speed of the winds increase. As previously mentioned, windstorms are generally defined as having sustained straight-line wind speeds of 40 mph or greater that last for one hour or longer, or winds of 58 mph (i.e. 50 knots) or greater for any duration. There have been 242 events windstorm events in Centre County since 1950. In 1991, the County experienced straight-line winds from a thunderstorm estimated at 83 knots (95 mph), the maximum wind speed on record for Centre County. These events can cause severe damage in the County resulting in power outages and road closures. On May 1, 2019, State Routes 45 and 192 were closed when over 100 trees were overblown by high winds (Centre County EMA, 2021). In 2019 alone, windstorm events caused $28,000 in damage. Previous high wind events from 2010 to 2020 are summarized in Table 4.3.11-4.

Table 4.3.11-4: Previous Windstorm Events in Centre County from January 2010 to April 2020 (NOAA NCEI, 2020a)

LOCATION	DATE	TYPE OF EVENT	MAGNITUDE (KNOTS)	DEATHS	INJURIES	PROPERTY DAMAGE ($)
GATESBURG	5/14/2010	Thunderstorm Wind	78	0	0	25,000
PINE GROVE MILLS	5/14/2010	Thunderstorm Wind	50	0	0	10,000
SOUTH PHILIPSBURG	6/6/2010	Thunderstorm Wind	50	0	0	5,000
BELLEFONTE	6/6/2010	Thunderstorm Wind	50	0	0	5,000
ZION	6/6/2010	Thunderstorm Wind	61	0	0	5,000
CENTRE HALL ARPT	7/21/2010	Thunderstorm Wind	56	0	0	25,000
BLANCHARD	7/23/2010	Thunderstorm Wind	50	0	0	5,000
HOWARD	7/23/2010	Thunderstorm Wind	50	0	0	5,000
STATE COLLEGE	10/11/2010	Thunderstorm Wind	50	0	0	5,000
BOALSBURG	4/28/2011	Thunderstorm Wind	50	0	0	5,000
CENTRE HALL	4/28/2011	Thunderstorm Wind	50	0	0	5,000
STATE COLLEGE	8/19/2011	Thunderstorm Wind	50	0	0	5,000
STATE COLLEGE	8/21/2011	Thunderstorm Wind	50	0	0	15,000
BELLEFONTE	5/26/2012	Thunderstorm Wind	50	0	0	5,000
INGLEBY	5/27/2012	Thunderstorm Wind	70	0	0	15,000
CENTRE HALL	5/29/2012	Thunderstorm Wind	50	0	0	5,000
(PSB)MID ST ARPT PHI	6/1/2012	Thunderstorm Wind	50	0	0	5,000
STATE COLLEGE	6/3/2012	Thunderstorm Wind	50	0	0	5,000
FILLMORE	6/29/2012	Thunderstorm Wind	50	0	0	5,000
JULIAN	6/29/2012	Thunderstorm Wind	50	0	0	5,000
BELLEFONTE ARPT	6/29/2012	Thunderstorm Wind	50	0	0	5,000
UNIONVILLE	6/29/2012	Thunderstorm Wind	50	0	0	5,000

Table 4.3.11-4: Previous Windstorm Events in Centre County from January 2010 to April 2020 (NOAA NCEI, 2020a)

LOCATION	DATE	TYPE OF EVENT	MAGNITUDE (KNOTS)	DEATHS	INJURIES	PROPERTY DAMAGE ($)
COLEVILLE	6/29/2012	Thunderstorm Wind	50	0	0	5,000
BELLEFONTE	6/29/2012	Thunderstorm Wind	50	0	0	5,000
FILLMORE	6/29/2012	Thunderstorm Wind	50	0	0	5,000
WOODYCREST	6/29/2012	Thunderstorm Wind	50	0	0	5,000
AXEMANN	6/29/2012	Thunderstorm Wind	50	0	0	5,000
CENTRE HALL PENNS AR	6/29/2012	Thunderstorm Wind	50	0	0	5,000
CENTRE HALL	6/29/2012	Thunderstorm Wind	50	0	0	5,000
MILLHEIM	6/29/2012	Thunderstorm Wind	50	0	0	5,000
HOWARD	7/7/2012	Thunderstorm Wind	50	0	0	5,000
AARONSBURG	7/18/2012	Thunderstorm Wind	50	0	0	5,000
MILLHEIM	7/18/2012	Thunderstorm Wind	50	0	0	5,000
GATESBURG	7/26/2012	Thunderstorm Wind	50	0	3	5,000
OAK HALL	7/26/2012	Thunderstorm Wind	50	0	0	2,500
PLEASANT GAP	7/26/2012	Thunderstorm Wind	50	0	0	5,000
BELLEFONTE ARPT	7/27/2012	Thunderstorm Wind	50	0	0	5,000
(UNV)UNIV PARK STATE	4/10/2013	Thunderstorm Wind	56	0	0	0
(UNV)UNIV PARK STATE	4/10/2013	Thunderstorm Wind	58	0	0	0
STATE COLLEGE	4/19/2013	Thunderstorm Wind	50	0	0	2,000
(PSB)MID ST ARPT PHI	5/10/2013	Thunderstorm Wind	50	0	0	2,500
STATE COLLEGE	5/22/2013	Thunderstorm Wind	53	0	0	0
BELLEFONTE ARPT	5/22/2013	Thunderstorm Wind	50	0	0	5,000
LEMONT	5/22/2013	Thunderstorm Wind	50	0	0	5,000
STATE COLLEGE	6/13/2013	Thunderstorm Wind	51	0	0	0
STATE COLLEGE	6/13/2013	Thunderstorm Wind	50	0	0	5,000
BELLEFONTE	6/25/2013	Thunderstorm Wind	50	0	0	5,000
PINE GROVE MILLS	6/27/2013	Thunderstorm Wind	50	0	0	2,000
JACKSONVILLE	6/27/2013	Thunderstorm Wind	50	0	0	2,000
SNYDERTOWN	6/27/2013	Thunderstorm Wind	50	0	0	2,500
CENTRE HALL	7/7/2013	Thunderstorm Wind	50	0	0	5,000
SPRING MILLS	7/7/2013	Thunderstorm Wind	50	0	0	5,000
MILLHEIM	7/7/2013	Thunderstorm Wind	50	0	0	2,000
SNOW SHOE STATION	7/10/2013	Thunderstorm Wind	50	0	0	2,000
CURTIN	9/12/2013	Thunderstorm Wind	50	0	0	2,000

Table 4.3.11-4: Previous Windstorm Events in Centre County from January 2010 to April 2020 (NOAA NCEI, 2020a)

LOCATION	DATE	TYPE OF EVENT	MAGNITUDE (KNOTS)	DEATHS	INJURIES	PROPERTY DAMAGE ($)
WOODYCREST	9/12/2013	Thunderstorm Wind	50	0	0	2,000
STATE COLLEGE	9/12/2013	Thunderstorm Wind	50	0	0	2,000
RISING SPGS	11/1/2013	Thunderstorm Wind	50	0	0	0
MINGOVILLE	11/18/2013	Thunderstorm Wind	50	0	0	0
WOODWARD	11/18/2013	Thunderstorm Wind	50	0	0	0
CENTRAL CITY	7/13/2014	Thunderstorm Wind	50	0	0	2,000
PINE GROVE MILLS	7/27/2014	Thunderstorm Wind	50	0	0	1,000
STATE COLLEGE	7/27/2014	Thunderstorm Wind	50	0	0	1,000
BELLEFONTE	7/27/2014	Thunderstorm Wind	50	0	0	1,000
MILESBURG	6/11/2015	Thunderstorm Wind	50	0	0	1000
ZION	6/11/2015	Thunderstorm Wind	50	0	0	1000
ZION	6/11/2015	Thunderstorm Wind	50	0	0	5000
MINGOVILLE	6/11/2015	Thunderstorm Wind	60	0	0	7000
OLD FORT	6/12/2015	Thunderstorm Wind	50	0	0	500
ZION	6/23/2015	Thunderstorm Wind	60	0	0	2000
STATE COLLEGE	6/23/2015	Thunderstorm Wind	60	0	0	1000
BOALSBURG	6/23/2015	Thunderstorm Wind	50	0	0	500
AARONSBURG	6/23/2015	Thunderstorm Wind	70	0	0	30000
WINGATE	7/24/2016	Thunderstorm Wind	52	0	0	2000
COLEVILLE	7/24/2016	Thunderstorm Wind	52	0	0	2000
BOALSBURG	7/24/2016	Thunderstorm Wind	52	0	0	2000
AXEMANN	7/24/2016	Thunderstorm Wind	52	0	0	2000
WINGATE	7/25/2016	Thunderstorm Wind	52	0	0	4000
SNYDERTOWN	7/25/2016	Thunderstorm Wind	52	0	0	4000
SANDY RIDGE	8/16/2016	Thunderstorm Wind	52	0	0	4000
WOODYCREST	8/16/2016	Thunderstorm Wind	52	0	0	7000
SNOW SHOE	5/1/2017	Thunderstorm Wind	52	0	0	5000
STORMSTOWN	5/1/2017	Thunderstorm Wind	52	0	0	2000
WOODYCREST	5/1/2017	Thunderstorm Wind	52	0	0	8000
STATE COLLEGE	5/1/2017	Thunderstorm Wind	52	0	0	2000
PINE GROVE MILLS	5/1/2017	Thunderstorm Wind	52	0	0	2000
STATE COLLEGE	5/1/2017	Thunderstorm Wind	52	0	0	2000
BOALSBURG	5/1/2017	Thunderstorm Wind	52	0	0	7000

Table 4.3.11-4: Previous Windstorm Events in Centre County from January 2010 to April 2020 (NOAA NCEI, 2020a)

LOCATION	DATE	TYPE OF EVENT	MAGNITUDE (KNOTS)	DEATHS	INJURIES	PROPERTY DAMAGE ($)
SNYDERTOWN	5/1/2017	Thunderstorm Wind	61	0	0	0
RISING SPGS	5/1/2017	Thunderstorm Wind	61	0	0	0
AARONSBURG	5/1/2017	Thunderstorm Wind	52	0	0	0
MILLHEIM	5/1/2017	Thunderstorm Wind	70	0	0	30000
MILLHEIM	5/1/2017	Thunderstorm Wind	61	0	0	0
COBURN	5/1/2017	Thunderstorm Wind	61	0	0	10000
HOWARD	5/30/2017	Thunderstorm Wind	52	0	0	3000
STORMSTOWN	6/16/2017	Thunderstorm Wind	52	0	0	1000
HOWARD	6/18/2017	Thunderstorm Wind	52	0	0	3000
MARENGO	8/19/2017	Thunderstorm Wind	52	0	0	4000
PINE GROVE MILLS	8/19/2017	Thunderstorm Wind	52	0	0	3000
PINE GROVE MILLS	8/19/2017	Thunderstorm Wind	52	0	0	6000
(PSB)MID ST ARPT PHI	1/12/2018	Thunderstorm Wind	52	0	0	2000
MILLHEIM	1/12/2018	Thunderstorm Wind	52	0	0	1000
NORTHERN CENTRE (ZONE)	4/4/2018	High Wind	52	0	0	0
SOUTHERN CENTRE (ZONE)	4/4/2018	High Wind	52	0	0	0
SOUTH PHILIPSBURG	5/15/2018	Thunderstorm Wind	52	0	0	4000
BUFFALO RUN	5/15/2018	Thunderstorm Wind	52	0	0	3000
COLEVILLE	5/15/2018	Thunderstorm Wind	52	0	0	5000
AXEMANN	5/15/2018	Thunderstorm Wind	52	0	0	2000
(UNV)UNIV PARK STATE	5/15/2018	Thunderstorm Wind	50	0	0	0
MINGOVILLE	7/4/2018	Thunderstorm Wind	52	0	0	3000
RUNVILLE	10/2/2018	Thunderstorm Wind	52	0	0	3000
BLANCHARD	10/2/2018	Thunderstorm Wind	52	0	0	2000
STATE COLLEGE	10/2/2018	Thunderstorm Wind	52	0	0	3000
OAK HALL	10/2/2018	Thunderstorm Wind	52	0	0	3000
OAK HALL	10/2/2018	Thunderstorm Wind	52	0	0	3000
RISING SPGS	10/2/2018	Thunderstorm Wind	52	0	0	3000
SOUTHERN CENTRE (ZONE)	2/24/2019	High Wind	52	0	0	0
NORTHERN CENTRE (ZONE)	2/24/2019	High Wind	52	0	0	0
CENTRAL CITY	4/14/2019	Thunderstorm Wind	52	0	0	1000
MARENGO	5/23/2019	Thunderstorm Wind	52	0	0	3000

Table 4.3.11-4: Previous Windstorm Events in Centre County from January 2010 to April 2020 (NOAA NCEI, 2020a)

LOCATION	DATE	TYPE OF EVENT	MAGNITUDE (KNOTS)	DEATHS	INJURIES	PROPERTY DAMAGE ($)
AXEMANN	6/29/2019	Thunderstorm Wind	52	0	0	0
PLEASANT GAP	6/29/2019	Thunderstorm Wind	52	0	0	9000
UNIONVILLE	7/6/2019	Thunderstorm Wind	52	0	0	2000
PORT MATILDA	8/18/2019	Thunderstorm Wind	52	0	0	3000
STORMSTOWN	8/18/2019	Thunderstorm Wind	52	0	0	2000
STATE COLLEGE	8/18/2019	Thunderstorm Wind	52	0	0	3000
STATE COLLEGE	8/18/2019	Thunderstorm Wind	52	0	0	5000
PORT MATILDA	4/13/2020	Thunderstorm Wind	52	0	0	3000
UNIONVILLE	4/13/2020	Thunderstorm Wind	52	0	0	2000
PLEASANT GAP	4/13/2020	Thunderstorm Wind	52	0	0	4000
TOTAL				0	0	540,500

4.3.11.4 Future Occurrence

For the period between 1950 and 2020, 13 tornadoes were reported in Centre County by NCEI. Therefore, the annual probability of being in the path of a tornado in Centre County is relatively minor. While the chance of being hit by a tornado is small, the damage that results when the tornado arrives can be potentially devastating. An F4 tornado, with a 0.01-percent-annual probability of occurring, can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings. While most of the recent windstorms and tornadoes have occurred outside of the county, their proximity contributes to future risk. Because more windstorms have been seen in the central Pennsylvania region, it is possible that an increasing number of tornadoes will be seen in Centre County.

According to NCEI, there have been over 242 wind events in Centre County between 1950 and 2020. Centre County experiences windstorm events more commonly than tornadoes, which causes power failures, loss of communication networks, and residents requiring temporary shelters and provision of supplies. The probability of tornadoes and windstorms in Centre County can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.11.5 Vulnerability Assessment

For tornadoes or high winds, aged and dilapidated structures or structures not built to applicable building codes are more susceptible to damage. Mobile homes and campgrounds are especially susceptible to damage due to tornado or high wind. Strong winds can rip roofs off of any dilapidated structures and overturn mobile homes. Past experiences with tornadoes in Centre County shows that death and injury are indeed possibilities. Vulnerability to the effects

of a tornado or high wind is somewhat dependent upon the age of a structure because as building codes become more stringent, buildings are capable of enduring greater wind forces.

In Centre County, high winds occur annually. The most common detrimental effects are interruptions in power supply and communications services due to downed wires and blocked roadways due to downed trees. Most severe power failures or outages are regional events. With the loss of power, electrical-powered equipment and systems will not be operational. Examples include lighting, HVAC and ancillary support equipment, communication systems, ventilation system, refrigerators, sterilizers, and medical equipment. This can cause food spoilage, loss of heat or air conditions, basement flooding (sump pump failure), lack of light, loss of water (well pump failure), lack of phone service, or lack of internet. While it is most often a short-term nuisance rather than a catastrophic hazard, utility interruptions can cause challenges for communications and response, particularly in more rural areas of the county. A worst-case scenario for utility interruption in Centre County would involve a power outage during winter snow or ice storms, which have the potential to cause power outages for prolonged periods of time.

High winds often occur during hurricanes, tropical storms, and nor'easters. Information about potential annualized losses due to hurricane winds can be found in Section 4.3.5.

All structures and infrastructure might be exposed to the effects of a tornado or other high winds. Depending upon the severity of a tornado or high wind, any existing structures might be damaged to some extent. Any future structures might be exposed to tornados or high winds as this hazard does not occur in specific locations. However, future buildings will be somewhat protected from the effects of tornado or high wind as they will meet the most current State building code requirements for bracing and roof design.

Manufactured housing (i.e. mobiles homes or trailers) is particularly vulnerable to high winds and tornadoes. The U.S. Census Bureau defines manufactured homes as "movable dwellings, eight feet or wider and 40 feet or longer, design to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without need of a permanent foundation (U.S. Census Bureau, 2020)." They can include multi-wide and expandable manufactured homes but exclude travel trailers, motor homes, and modular housing. Due to their lightweight and often unanchored design, manufactured housing is extremely vulnerable to high winds and will generally sustain the most damage.

As of 2018, there are an estimated total of 3,320 mobile home structures in Centre County. Table 4.3.11-5 details the total residential structures and the number of mobile home structures in each municipality. Benner Township, Potter Township, and Boggs Township have the most mobile homes, 655, 312, and 253 respectively. Benner and Huston Townships have the highest percentages of residential structures that are mobile homes (26 percent and 25 percent, respectively). College Township, Harris Township, and Howard Borough are the only municipalities in the County that have no mobile homes. Zoning restrictions within these

municipalities are most likely the cause of this difference. Higher concentrations of mobile home structures increase the vulnerability of the area to tornadoes and windstorms.

Table 4.3.11-5: Mobile homes in Centre County (U.S. Census Bureau, 2018)

MUNICIPALITY	TOTAL RESIDENTIAL STRUCTURES	TOTAL MOBILE HOMES	PERCENT MOBILE HOMES
Bellefonte Borough	3,003	10	0.33%
Benner Township	2,480	655	26%
Boggs Township	1,277	253	20%
Burnside Township	366	80	22%
Centre Hall Borough	492	6	1%
College Township	3,974	0	0%
Curtin Township	455	73	16%
Ferguson Township	8,083	77	1%
Gregg Township	1,129	71	6%
Haines Township	866	59	7%
Halfmoon Township	985	46	5%
Harris Township	2,560	0	0%
Howard Borough	287	0	0%
Howard Township	385	65	17%
Huston Township	615	153	25%
Liberty Township	1,078	176	16%
Marion Township	455	19	4%
Miles Township	881	64	7%
Milesburg Borough	482	44	9%
Millheim Borough	319	21	7%
Patton Township	7,198	48	1%
Penn Township	646	84	13%
Philipsburg Borough	1,539	120	8%
Port Matilda Borough	294	31	11%
Potter Township	1,826	312	17%
Rush Township	1,971	120	6%
Snow Shoe Borough	349	21	6%
Snow Shoe Township	1,015	153	15%
Spring Township	3,717	61	2%
State College Borough	14,099	70	0.50%
Taylor Township	450	84	19%
Union Township	649	136	21%

Table 4.3.11-5: Mobile homes in Centre County (U.S. Census Bureau, 2018)

MUNICIPALITY	TOTAL RESIDENTIAL STRUCTURES	TOTAL MOBILE HOMES	PERCENT MOBILE HOMES
Unionville Borough	93	6	6%
Walker Township	1,927	173	9%
Worth Township	367	29	8%
Total	**66,312**	**3,320**	**5%**

Overall, however, tornado and windstorm events are not specific to select parts of the County. Rather, a tornado could strike in any part of the County at any time and could cause as much or as little damage as possible for the given magnitude event. Historically, however, Centre County has been most typically impacted by minimal (EF0-EF2) tornadoes, with no event resulting in significant monetary damages.

Environmental impacts from tornadoes can include debris in streams, wetlands, and other sensitive environmental features. Tree damage is commonly seen after high wind events. Hazardous material facilities should meet design requirements for the wind zones identified in Figure 4.3.5-1 in order to prevent release of hazardous materials into the environment.

4.3.12 Wildfire

4.3.12.1 Location and Extent

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly 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 fields, grass, and brush as well as in the forest itself. Under dry conditions or drought, wildfires have the potential to burn forests as well as croplands. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildland fires are caused by human carelessness, negligence, and ignorance. In 2017, debris burning accounted for the largest number of wildfires, while incendiary causes accounted for the largest number of acres burned in Pennsylvania (DCNR, 2017). However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion.

Portions of the Bald Eagle (eastern County border), Moshannon (east of the Borough of Philipsburg and south of I-80), Rothrock (southern County border), and Sproul (northern County border) State Forests are located in Centre County. These forests, as well as several State Gameland areas, are of particular concern for wildfire events due to the large area of expanded woodland. However, a wildfire could develop in any portion of the County.

4.3.12.2 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.

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 impact the potential for severe erosion, silting of stream beds and reservoirs, and flooding due to ground-cover loss following a fire event. Approximately 73 percent of Centre County consists of forested areas, in many cases surrounded by cropland and pastures (CCPCDO, 2014). 98 percent of wildfires in Pennsylvania are caused by people, often by debris burns (DCNR-BOF, 2015).

In addition to the risk wildfires pose to the general public and property owners, 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 acres away from the communities that they are chartered to protect.

One of the more significant wildfire events in recent history occurred in May of 2006 (Bosak, 2006). Known as the Treaster Kettle Fire, this incident occurred in Harris Township. Fire companies from all of Centre County as well as companies from Huntingdon, Blair, Mifflin, and Lycoming Counties fought this blaze. DCNR Bureau of Forestry (DCNR-BOF) provided a helicopter, airplane, and multiple dozers to combat the fire. The fire was believed to have been started by a downed power line, and it spread quickly due to low relative humidity and dry leaf cover. The fire burned over 400 acres and was responsible for $86,000 in damages. The worst-case scenario for a wildfire in Centre County would be a similar uncontrolled fire that spreads from forested areas into bordering residential areas, causing significant damage to homes and other assets in addition to natural resources. See Table 4.3.12-3 for details on structures and critical facilities in high hazard and forested areas.

4.3.12.3 Past Occurrence

From 2008 to 2013, there were 80 reported wildfire events in the County (see Table 4.3.12-1 and Figure 4.3.12-2). This is the most recent data available from DCNR-BOF. However, it should be noted that these reported events may not accurately reflect the number of wildfires that actually occurred in Centre County during that time. For example, information on wildfire events occurring on private land is not available. There were 13 wildfires in Centre County in both 2011 and 2012, while there were only five wildfires reported in 2013. The largest wildfire occurred in Rush Township in 2009, which spanned nearly 84 acres.

Table 4.3.12-1: Wildfire Events Reported in Centre County from 2008-2013 (DCNR – BOF, 2015)

YEAR	MUNICIPALITY	FIRE EVENTS	AREA (acres)
2008	Boggs Township	1	0.2
2008	Gregg Township	2	11.6

Table 4.3.12-1: Wildfire Events Reported in Centre County from 2008-2013 (DCNR – BOF, 2015)

YEAR	MUNICIPALITY	FIRE EVENTS	AREA (acres)
2008	Rush Township	4	2.33
2008	Taylor Township	1	0.26
2008	Walker Township	1	0.25
2009	College Township	1	1
2009	Huston Township	4	2.425
2009	Rush Township	8	83.7347
2009	Snow Shoe Township	1	3
2010	Burnside Township	2	5.1
2010	College Township	1	1
2010	Ferguson Township	3	0.9859
2010	Haines Township	1	1
2010	Huston Township	2	2.632
2010	Marion Township	1	1.08
2010	Potter Township	1	4
2010	Rush Township	9	36.6775
2010	Snow Shoe Township	2	14
2010	Taylor Township	1	0.5
2010	Union Township	1	5
2010	Walker Township	1	1
2010	Worth Township	1	1.559
2011	Harris Township	1	0.01
2011	Huston Township	2	5.8
2011	Patton Township	1	2
2011	Rush Township	1	0.01
2011	Worth Township	1	0.1
2012	Boggs Township	3	20.7
2012	Burnside Township	2	14
2012	College Township	1	0.5
2012	Curtin Township	1	6.5
2012	Ferguson Township	2	14.14
2012	Patton Township	1	1
2012	Penn Township	1	11
2012	Philipsburg Borough	1	0.02
2012	Rush Township	1	0.01
2012	Snow Shoe Township	3	4.1
2012	Taylor Township	1	0.01

Table 4.3.12-1: Wildfire Events Reported in Centre County from 2008-2013 (DCNR – BOF, 2015)

YEAR	MUNICIPALITY	FIRE EVENTS	AREA (acres)
2012	Union Township	1	4.8
2012	Worth Township	1	0.01
2013	Liberty Township	2	29
2013	Patton Township	1	2.8
2013	Rush Township	1	1.47
2013	Snow Shoe Township	1	0.33
2013	Worth Township	1	0.01

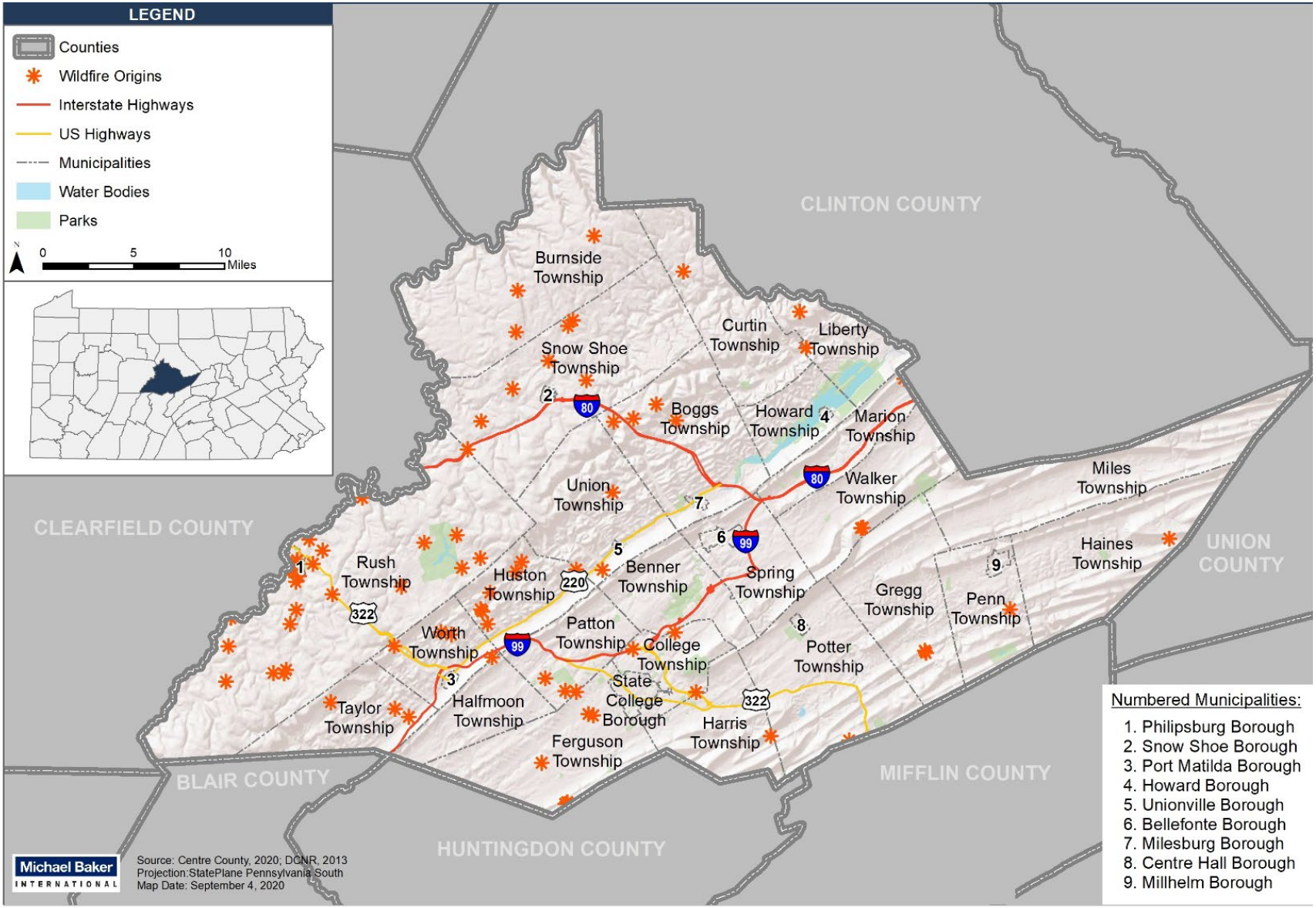
Figure 4.3.12-1 displays the location of past wildfire events in Centre County from 2008 to 2013. As shown in the map, wildfires generally occur throughout all of Centre County, although there is a cluster of events in Rush Township and Philipsburg.

Centre County 9-1-1 provided fire reports for 2009-2013 and 2016-2020, which detail the number of calls the 9-1-1 center received regarding fires. These calls were categorized, with wildfires as one of the many fire-related call types. According to the 9-1-1 call log, 624 wildfire events were reported in Centre County between 2009 and 2013 (Centre County 9-1-1, 2015). Since this number is so much larger than those reported in Table 4.3.12-1, it is likely that many of these fires never developed into full-fledged wildfires. Additionally, it is possible that multiple calls were made for the same fire incident. Between 2016 and 2020, 194 wildfires were reported in Centre County (Centre County 9-1-1, 2020).

Centre County OES provided reports from 2015 through January 2021, which detail calls received regarding wildfires. In April 2018, three wildfire events were reported. Two of these occurred in Boggs Township, and each covered around 20-30 acres. Air tankers were deployed to suppress these fires. Later in the month, there was a large wildfire event between 700 and 800 acres in Rush Township, which is described in detail below. In March 2019, a wildfire was set adjacent to development in Marion Township. In August 2020, there were 11 wildland fires throughout the county between the 22nd and 23rd. These were caused by drought conditions.

On April 24, 2018, Centre County experienced a wildfire reaching over 700 acres across Rush Township (Rushton, 2018). The fire was set as a prescribed burn by the Pennsylvania Department of Conservation and Natural Resources in Sproul State Forest. However, high winds blew embers about a half-mile outside of the operation area. DCNR quickly employed a contingency plan, but suppression activities were hampered by high winds, heavy natural fuels, and difficult terrain. This incident shows the need for emergency response even during planned events.

Figure 4.3.12-1: Wildfire History in Centre County, 2008-2013



DCNR-BOF no longer reports wildfires at the County level, but instead by State Forest District. Centre County falls in four different State Forest Districts: Sproul (10) in the North, Bald Eagle (7) in the East, Rothrock (5) in the South, and Moshannon (9) in the West. Table 4.3.12-2 below shows the number of wildfires in each of these districts between 2014 and 2019. This data represents several counties in Central Pennsylvania, showing a regional view of past wildfire occurrences for Centre County.

Table 4.3.12-2: List of Wildfire events reported from 2014-2019 by State Forest District (DCNR – BOF, 2019)

YEAR	DISTRICT 5		DISTRICT 7		DISTRICT 9		DISTRICT 10	
	# FIRES	ACRES BURNED	# FIRES	ACRES BURNED	# FIRES	ACRES BURNED	# FIRES	ACRES BURNED
2014	25	64.7	28	189.2	70	219.2	7	115.9
2015	19	76.4	28	44.2	51	97.9	9	20.8
2016	23	86.2	20	27.6	68	184.9	10	115.3
2017	9	15.4	14	18.7	33	84.8	4	6.6
2018	10	12.8	20	38.1	45	101	11	739.6
2019	9	10.5	15	12.6	20	39.6	7	33.3
TOTAL	95	226	125	330.4	287	727.4	48	1,031.5

4.3.12.4 Future Occurrence

Previous events indicate that annual wildfire occurrences in the County are expected. 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 an urban fire or wildfire occurring in Centre County is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.12.5 Vulnerability Assessment

DCNR-BOF conducted an independent wildfire hazard risk assessment for the municipalities in Centre County in 2010, which is the most recent assessment of this type available. The analysis identified potential wildfire hazard based on conditions that affect wildfire ignition and/or behavior such as fuel, topography and local weather. Results of the assessment are shown in Figure 4.3.12-2, which indicates that 12 of the 35 municipalities in Centre County have a "high" hazard rating. Based on additional wildfire risk and vulnerability information reviewed, these results are largely consistent with current conditions in 2020. In considering additional factors that influence risk, Figure 4.3.12-3 shows wooded areas throughout Centre County in 2020. The County has significant forest coverage, 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, Burnside, Snow Shoe, Curtin, and Liberty Townships are vulnerable to wildfire hazard. More populated communities around State College Borough have less coverage but are still surrounded by a significant amount of forested land. These communities that have more developed areas adjacent to wooded land also have potentially greater vulnerability to wildfire hazard, which is also generally consistent with the high hazard potential areas in Figure 4.3.12-2.

Figure 4.3.12-2: Wildfire Hazard Potential in Centre County, 2010

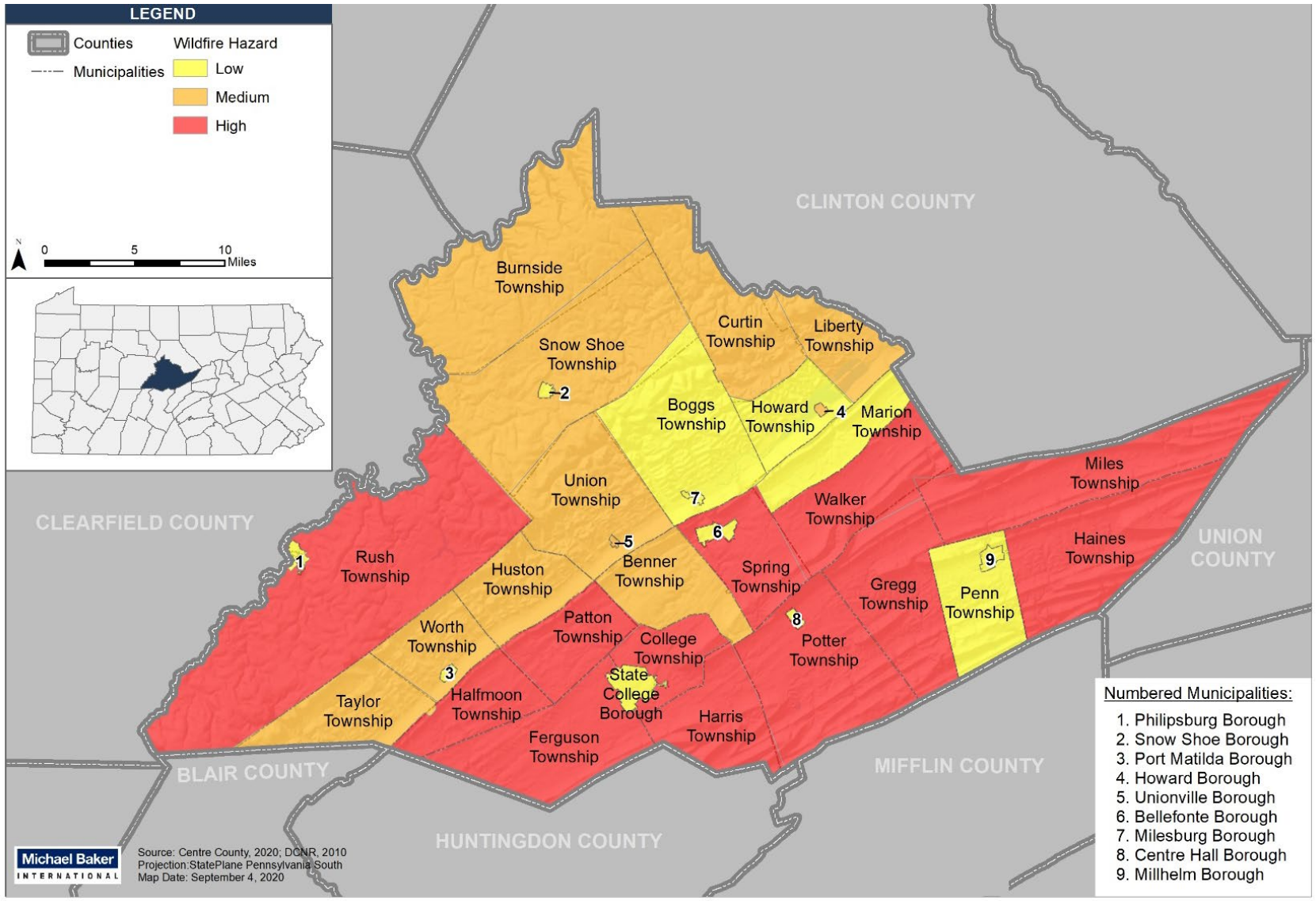


Figure 4.3.12-3: Wooded Areas in Centre County

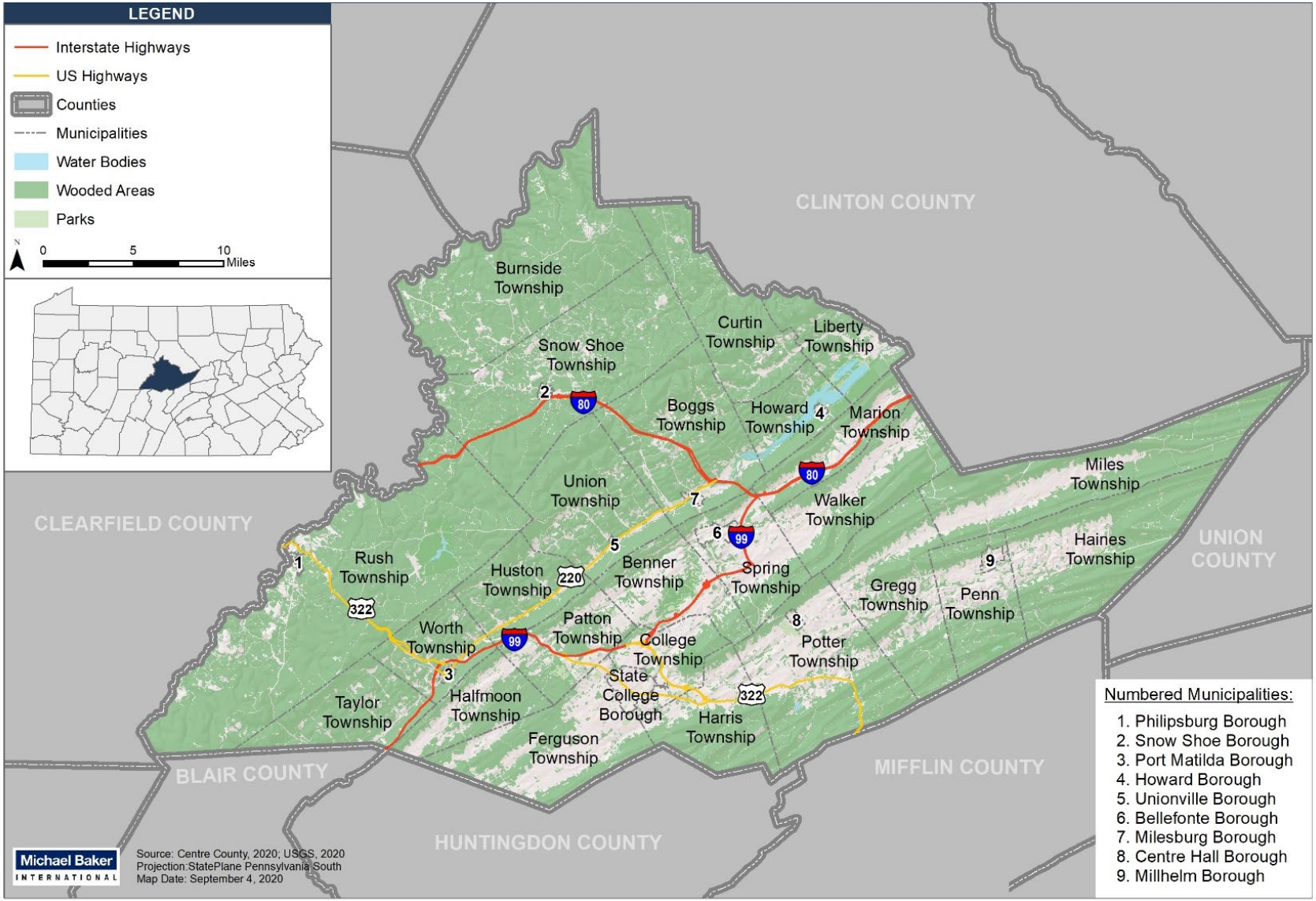


Table 4.3.12-3 lists the total addressable structures and critical facilities (excluding oil and gas wells) in each municipality that are located in forested land use areas. As indicated in the table, Patton Township has the most vulnerable structures located in wooded areas, with 251 structures. Ferguson and Snow Shoe Townships have the next highest number of structures in these areas, with 66 and 61, respectively. Rush Township has the most critical facilities in wooded areas (nine), followed by Benner Township (four) and Potter Township (four). Critical facilities in wooded areas are primarily dams and water and sewer treatment plants. Wooden and natural dams in these areas could be considered for wildfire mitigation to reduce damage to dams, which could pose flood risk. There is one airport, one day care center, and one school in vulnerable wildfire areas. Mitigation tactics like brush clearing and prescribed burns around these facilities could reduce risk to wildfire events.

Table 4.3.12-3: Structures and Critical Facilities Vulnerable to Wildfire

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN WOODED AREAS	PERCENT STRUCTURES IN WOODED AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN WOODED AREAS	PERCENT CRITICAL FACILITIES IN WOODED AREAS
Bellefonte Borough	2,658	2	0%	17	0	0%
Benner Township	2,369	23	1%	26	4	15%
Boggs Township	1,598	29	2%	9	1	11%
Burnside Township	441	21	5%	3	2	67%
Centre Hall Borough	579	0	0%	4	0	0%
College Township	4,810	36	1%	44	2	5%
Curtin Township	448	10	2%	2	1	50%
Ferguson Township	6,949	66	1%	27	3	11%
Gregg Township	1,179	12	1%	10	2	20%
Haines Township	1,003	26	3%	7	2	29%
Halfmoon Township	1,089	24	2%	5	3	60%
Harris Township	2,798	45	2%	8	2	25%
Howard Borough	298	0	0%	4	0	0%
Howard Township	523	15	3%	1	1	100%
Huston Township	684	13	2%	1	1	100%
Liberty Township	1,233	27	2%	5	1	20%
Marion Township	501	17	3%	3	2	67%
Miles Township	944	19	2%	15	3	20%
Milesburg Borough	475	1	0%	3	0	0%
Millheim Borough	427	0	0%	4	0	0%
Patton Township	5,315	251	5%	22	2	9%
Penn Township	881	18	2%	15	2	13%
Philipsburg Borough	1,309	1	0%	9	0	0%
Port Matilda Borough	256	1	0%	4	0	0%
Potter Township	2,015	26	1%	15	4	27%
Rush Township	2,462	58	2%	26	9	35%
Snow Shoe Borough	346	0	0%	2	0	0%
Snow Shoe Township	1,347	61	5%	8	3	38%
Spring Township	3,654	42	1%	19	2	11%

Table 4.3.12-3: Structures and Critical Facilities Vulnerable to Wildfire

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN WOODED AREAS	PERCENT STRUCTURES IN WOODED AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN WOODED AREAS	PERCENT CRITICAL FACILITIES IN WOODED AREAS
State College Borough	6,861	14	0%	36	0	0%
Taylor Township	497	15	3%	1	0	0%
Union Township	775	13	2%	5	1	20%
Unionville Borough	134	1	1%	0	0	0%
Walker Township	2,038	46	2%	13	2	15%
Worth Township	471	11	2%	2	1	50%
Total	**59,367**	**944**	**2%**	**375**	**56**	**15%**

Table 4.3.13-4 shows the number of oil and gas wells located in wildfire hazard areas. All municipalities with wells have at least one well that is vulnerable to wildfire hazard. The municipalities with the most vulnerable wells are Snow Shoe Township (268), Burnside Township (265), and Curtin Township (124).

Table 4.3.12-4: Conventional and Unconventional Oil and Gas Well Wildfire Vulnerability in Centre County, 2020

MUNICIPALITY	TOTAL OIL AND GAS WELLS	TOTAL OIL AND GAS WELLS IN WOODED AREAS	PERCENT OIL AND GAS WELLS IN WOODED AREAS
Boggs Township	51	28	55%
Burnside Township	683	265	39%
Curtin Township	192	124	65%
Liberty Township	2	2	100%
Marion Township	1	1	100%
Rush Township	60	33	55%
Snow Shoe Township	615	268	44%
Taylor Township	2	2	100%
Union Township	7	5	71%
Worth Township	3	1	33%
Total	**1,616**	**729**	**45%**

Centre County residents are protected by 28 fire companies, all of which are volunteer departments (Centre County Fire, 2020). Reliance on volunteers is not likely to change as the county will remain largely rural in character, and certainly throughout the next hazard mitigation planning period. Fire companies, particularly volunteer fire companies, face significant challenges today and into the future. Maintaining sufficient numbers of capable volunteers is an omnipresent concern for volunteer fire companies throughout the Commonwealth, including Centre County. The pool of available volunteers has been steadily declining, a trend likely to continue throughout the next planning period. The statewide decline in volunteers is driven by many factors, all of which are common to Centre County: economic pressures necessitating dual income households, loss of local employment opportunities, and reduced reliance on service organizations for social activity and networking. These pressures will continue, but they are not expected to result in the loss of any individual fire company.

4.3.13 Winter Storm

4.3.13.1 Location and Extent

Heavy snow or ice occurs throughout the Commonwealth of Pennsylvania. Every municipality in Centre County is affected by these storms. Centre County experiences all levels of winter storms from ice storms and freezing rain to heavy snow and blizzards. Generally, the average annual snowfall is consistent throughout the County, with the area receiving between 31 and 40 inches of snow annually (see Figure 4.3.13-2 below). This dataset from NOAA in 2013 is the most current, comprehensive, and publicly available geospatial data at the time of this Plan Update. This map continues to depict current conditions. According to the NWS, median winter season snowfall from 1980 through 2020 is 38.6 inches in State College. Figure 4.3.13-1 shows seasonal snowfall at the State College, PA Co-Operative Observation Site since 1980. Additionally, data from the most recent 2019-2020 season indicate that snowfall remains heavier in the southwestern part of the County as shown in Figure 4.3.13-2 (NOAA NWS, 2020d).

Figure 4.3.13-1: Seasonal Snowfall at State College, PA Co-Operative Observation Site, 1980-2020

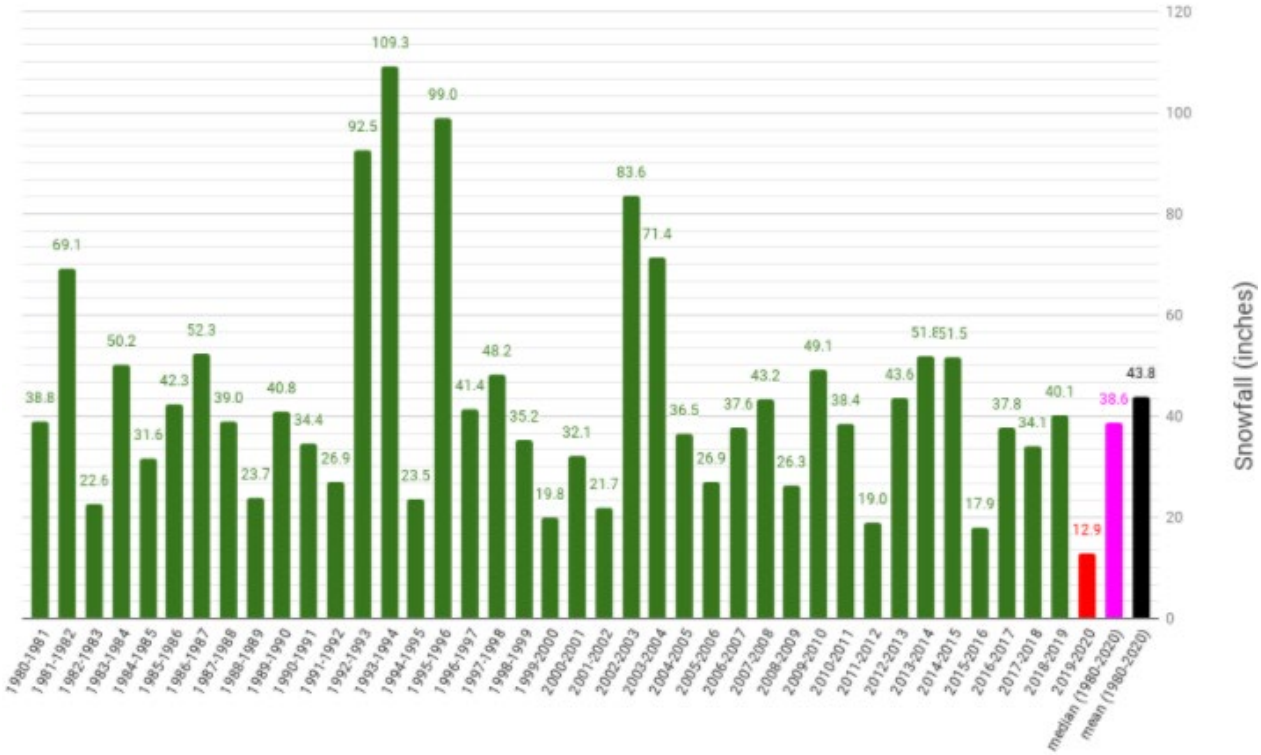
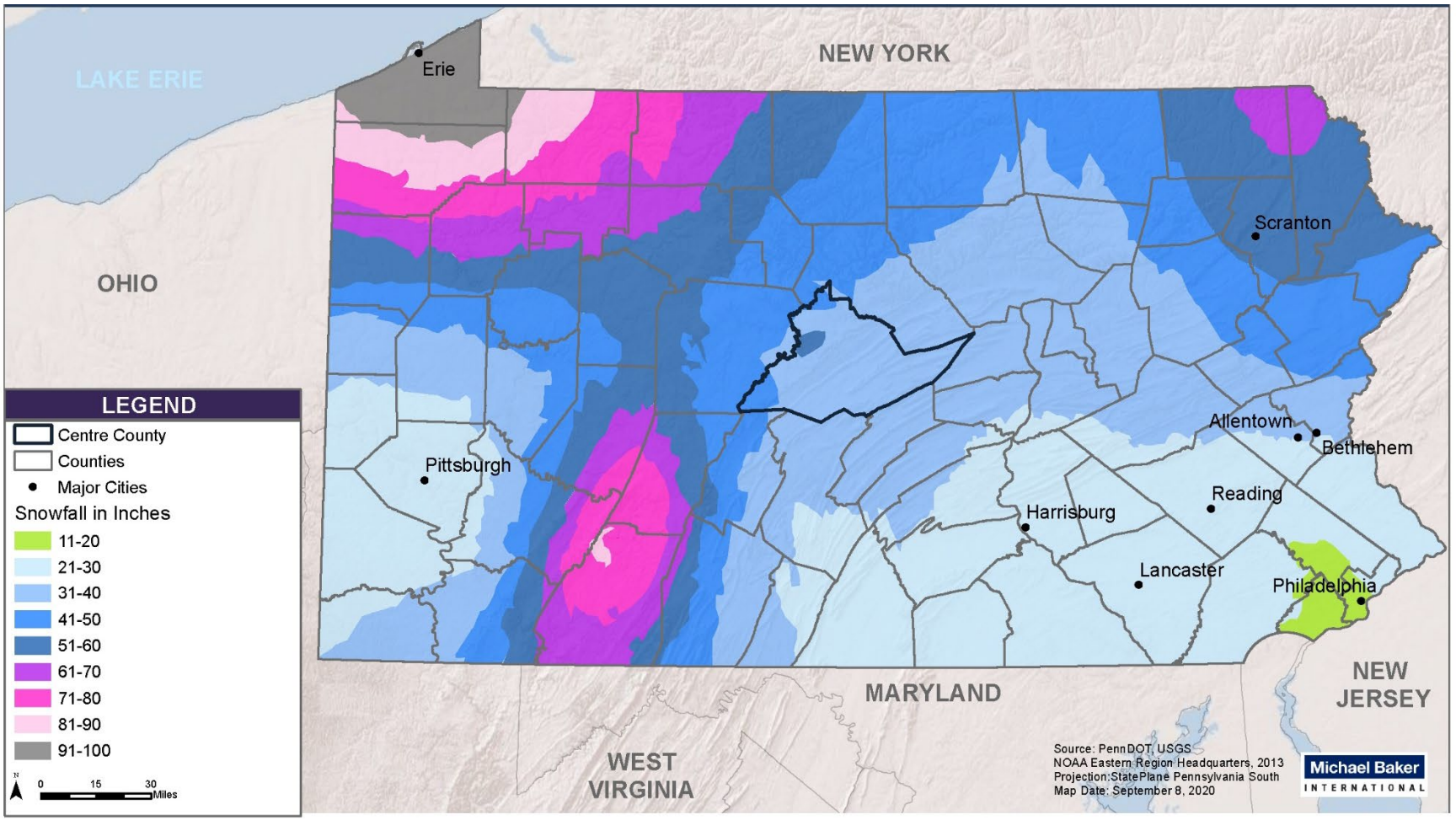


Figure 4.3.13-2: Mean Annual Snowfall for Pennsylvania and Centre County, 2013



4.3.13.2 Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice and sometimes strong winds. Because winter storms are a regular occurrence in Centre County, they are considered hazards only when they result in damage to specific structures and/or overwhelm local capabilities to handle disruptions to traffic, communications, and electric power. 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 can include one or more of the following weather events:

1. Heavy Snowstorm: Accumulations of four inches or more in a six-hour period, or six inches or more in a 12-hour period.
2. Sleet Storm: Sleet if 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.
3. 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.
4. Blizzard: According to NWS, 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 Centre County; however, storms that produce blizzard-like conditions are a common occurrence.
5. Severe Blizzard: Wind velocity of 45 mph, temperatures of 10° Fahrenheit or lower, a high density of snow with visibility frequently measured in feet prevailing over an extended period time.

Any of the above events can result in the closing of secondary roads, particularly in rural locations, 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. The blizzard of 1996, one of several winter storm events documented in Section 4.3.13.3, represents the largest impact Centre County is anticipated to encounter from a winter storm hazard. During this event, heavy snow fell on the County over two days, resulting in two to three feet of snow in places. This event

was exacerbated when rainfall and unusually warm temperatures resulted in flooding due to extensive melting of the snowpack. County specific damage estimates were unavailable, but damages for the entire Susquehanna River basin had been estimated at $600M (NOAA NWS, 1996). A storm of this magnitude could be considered a worst-case scenario winter storm for Centre County.

4.3.13.3 Past Occurrence

The Commonwealth of Pennsylvania has a long history of severe winter weather. In March of 1993, declaration of a state-wide snow emergency restricted travel on all state highways. Snowfall varied throughout the County from 14 to 36 inches with snow drifts up to 10 feet in some places. The Blizzard of 1996, which began Sunday, January 7, 1996, brought an additional 18 inches of snow on top of 10 inches already on the ground. As discussed in Section 4.3.4, extensive severe flooding occurred when heavy rains melted the 28 inches snowpack five days later, causing Governor Ridge to declare a state of emergency. In October 2002, there were widespread, prolonged power outages in some areas of the County, including the heavily populated Centre Region, due to heavy, wet snow and ice accumulations that resulted in $1 million worth of property damages in northern Centre County.

Sudden snow squalls where interstate highways, such as I-80, I-99, and US-322, traverse the mountains can also create a hazard to these high traffic areas. As an example, on January 6, 2004, Centre County experienced its first large scale chain reaction pileup on I-80. This accident occurred when a sudden snow squall caused the roadway to flash freeze and created whiteout conditions. During this incident, forty-seven vehicles, including 30 tractor trailers, crashed, killing six and injuring at least 11 people enough to require emergency medical transport.

The aftermath of this disaster is shown in Figure 4.3.13-3. Emergency responders from 84 agencies from Centre County and seven other counties battled frigid temperatures to extinguish fires that caused multiple explosions. The situation was further complicated when 80 drums of hazardous waste in a tractor trailer in the middle of the pile began to leak. See Section 4.3.19 for more information about transportation accidents.

Figure 4.3.13-3: Aftermath of the January 6, 2004 Snowstorm Pileup on I-80

Mean annual snowfall in Centre County can range from 40 to 60 inches. Three of the fifteen Presidential Disaster and Emergency Declarations affecting Centre have been in response to hazard events related to winter storms (see Table 4.2-1). The number of winter storm events occurring each year in Centre County and associated damages are listed in Table 4.3.13-1.

Stakeholders during the 2015 Plan Update process provided additional information about winter storm incidents throughout Centre County, which included:

- It is essential to maintain Route 144 through Snow Shoe Borough since I-80 traffic diverts to this road during snow storms and causes traffic problems
- Winter storms impact all Marion Township roads
- Winter storms impact the wooded neighborhoods of Park Forest Village (Patton and Ferguson Townships) and College Heights (State College Borough)

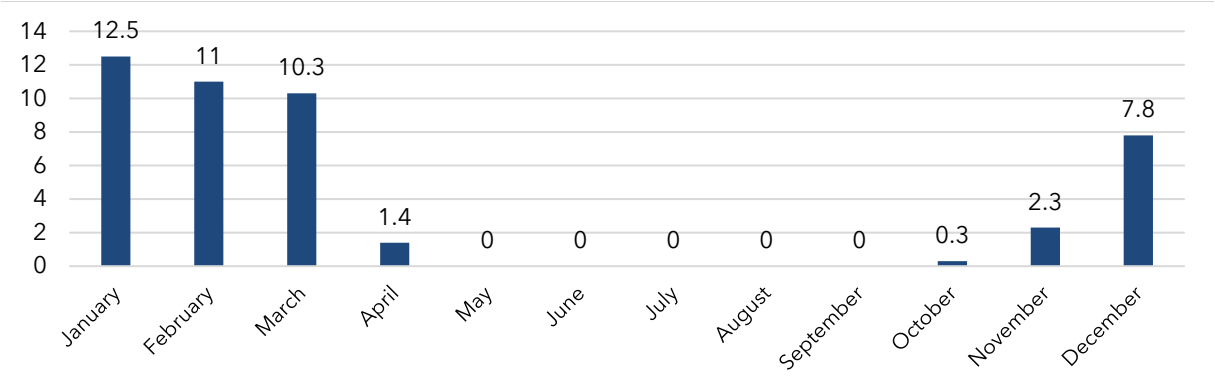
4.3.13.4 Future Occurrence

Approximately 35 winter storms occur across Pennsylvania and about five occur in Centre County annually. Winter storms are a regular, annual occurrence in Centre County and should be considered *highly likely* as defined by the Risk Factor methodology probability criteria (see Table 4.4-1). Figure 4.3.13-4 shows the 1981-2010 snowfall normal as recorded at the State College Weather Station. As shown, State College experiences regular snowfall during winter months, particularly from December to March.

Table 4.3.13-1: Previous Winter Storm Events Impacting Centre County from 1996-2020 (NOAA NCEI, 2020a)

YEAR	NUMBER OF EVENTS	DAMAGES ($)
1996	8	*not provided*
1997	8	*not provided*
1998	5	*not provided*
1999	11	*not provided*
2000	8	*not provided*
2001	2	$8,000
2002	10	$ 1,000,000
2003	8	*not provided*
2004	12	*not provided*
2005	13	*not provided*
2007	10	*not provided*
2008	11	*not provided*
2009	9	*not provided*
2010	3	*not provided*
2011	5	*not provided*
2012	3	*not provided*
2013	4	*not provided*
2014	10	*not provided*
2015	4	*not provided*
2016	2	*not provided*
2017	4	*not provided*
2018	2	*not provided*
2019	5	*not provided*
Total	157	$1,008,000

Figure 4.3.13-4: 30-Year Snowfall Normal (Inches) by Month at State College Weather Station (NOAA NCEI, 2020b)



4.3.13.5 Vulnerability Assessment

In Centre 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 not collapsed structures but traffic accidents and interruptions in power supply and communications services.

Some rural areas of the county are susceptible to isolation due to the loss of telephone communication and road closings. Power failures and interruption of water supplies are not uncommon from ice storms as well as heavy snow or blizzard conditions. These include the more sparsely populated areas of Liberty, Curtin, Snow Shoe, Burnside and Rush Townships, and remote farms in Miles, Haines, and Penn and Gregg Townships. There are also small mountain communities, such as Monument and Orviston, which are particularly at risk of isolation because of their mountaintop locations. A few areas have been isolated for as long as eight days. Emergency medical supplies, food, and fuel are sometimes required during these storms. Particular areas of vulnerability include low-income and elderly populations, 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.

Motorists may occasionally become stranded on major highways, especially I-80 in Snow Shoe Township, during these storms. Stranded motorists are also likely on I-99 and US 322 in remote and mountain locations, as in such corridors found in Taylor and Rush Townships.

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 a 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 to 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 Centre 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 Centre County built prior to 1940 according to the ACS 2018 five-year estimates. State College Borough has the most structures of any municipality in the county built prior to 1940 (over 1,500). However, Howard and Unionville Boroughs have the largest proportion of housing units built prior to 1940 (50.9 and 50.5 percent, respectively).

While the U.S. Census Bureau provides estimates for residential structures, the age of non-residential structures is not available.

Table 4.3.13-2: Housing Units Built Prior to 1940 in Centre County (U.S. Census Bureau, 2018)

MUNICIPALITY	NUMBER OF HOUSING UNITS BUILT PRIOR TO 1940	PERCENT OF TOTAL HOUSING UNITS
Bellefonte Borough	850	28.30%
Benner Township	145	5.90%
Boggs Township	258	20.20%
Burnside Township	47	12.80%
Centre Hall Borough	173	35.20%
College Township	207	5.20%
Curtin Township	123	27%
Ferguson Township	475	5.90%
Gregg Township	276	24.50%
Haines Township	280	32.30%
Halfmoon Township	88	8.90%
Harris Township	101	4%
Howard Borough	146	50.90%
Howard Township	43	11.20%
Huston Township	94	15.30%
Liberty Township	258	23.90%
Marion Township	44	9.70%
Miles Township	326	37%
Milesburg Borough	166	34.40%
Millheim Borough	140	43.90%
Patton Township	295	4.10%
Penn Township	135	20.90%
Philipsburg Borough	712	46.30%
Port Matilda Borough	117	39.80%
Potter Township	259	14.20%
Rush Township	574	29.10%
Snow Shoe Borough	99	28.40%
Snow Shoe Township	224	22.10%
Spring Township	677	18.20%
State College Borough	1,516	10.80%
Taylor Township	63	14%
Union Township	102	15.70%
Unionville Borough	47	50.50%
Walker Township	267	13.90%
Worth Township	52	14.20%
TOTAL	9,379	14.10%

As all structures and infrastructure in Centre County will be exposed to heavy snow and ice, all of Centre County has adopted the 2009 IBC and IRC building codes. New construction will be able to withstand the weight of heavy snow or ice.

HUMAN-MADE HAZARDS

4.3.14 Civil Disturbance

4.3.14.1 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 (Brennan, 2014).
- Economic Collapse, Recession: Very slow or negative growth (The Economist, 2009).
- 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 Centre County history. The student population of Penn State University and the population influxes during big events sometimes lead to spontaneous celebrations that create problems requiring external support.

Concentrations of large crowds has typically occurred in the 200 and 300 blocks of Beaver Avenue in State College Borough, known locally as Beaver Canyon where it is flanked by apartment towers. In this location, mobs have caused extensive damage to motor vehicles, business places, and other property. There were also personal injuries to rioters and police. These events required aid from police agencies from all parts of the County, and, for the larger riots, other parts of the State. They resulted in numerous arrests.

In recent years there have been demonstrations at County facilities, including the County Courthouse. Demonstrators have protested around local and national topics. These locations are likely places for public demonstrations in the future. In 2019, Centre County commissioners adopted an ordinance that establishes guidelines for security on County property. Anyone that enters County property is subject to searches of persons, packages, and containers, as well as monitoring by security cameras. The ordinance also established a Security Committee, which is tasked with proposing security procedures, policies, and/or ordinances to the County Board of Commissioners regarding County Property (Centre County, 2019a). The State Correctional Institution (SCI) at Rockview also has the potential for large-scale civil disorder, though this has never occurred to date. Rockview, is located in Benner Township, off Pennsylvania Route 26 north of State College, at the foot of Mount Nittany in the Nittany Valley. It is a medium-security institution for male prisoners, and currently houses over 2,400 inmates (PA DOC, 2020a). Additionally, SCI Benner, also in Benner Township, is a medium-security facility that opened in 2013 and houses more than 2,000 inmates (PA DOC, 2020b). This facility is also vulnerable to civil disturbance incident.

4.3.14.2 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 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 to 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):

- 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 their frustrations after political defeat, or violent mobs at political protests or rallies.
- Escape Mob: An escape mob is attempting to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs are generally difficult to control can be characterized by unreasonable terror.
- 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.
- 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 Centre 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 also involve property damage comparable to or greater than that which occurred in the riots of 1998 and 2011, which are discussed in Section 4.3.14.3.

4.3.14.3 Past Occurrence

Notable civil disturbance events include the 1980 Penn State University Employees Strike, the 1982 Nebraska-Penn State Football Game, the 1982 and 1986 Penn State National Football Championships, the Central Pennsylvania Festival of the Arts in both 1998 and 2000, and in March 2001 after Penn State's defeat in the National College Athletic Association (NCAA) Basketball playoffs.

A damaging event occurred on July 12, 1998 at the Central Pennsylvania Festival of the Arts. A mob of approximately 1,500 resulted in $150,000 in property damage, more than 20 arrests, and 14 injured police officers.

On October 25, 2008, after the 13-6 Penn State win against the Ohio State Buckeyes, Nittany Lions fans celebrated by pulling down poles and signs and tossing objects out of balconies. Police arrived in riot gear to break up the crowd. Celebrations began at 11:30 p.m. and did not get cleared until around 1:30 a.m. The most damage done in this incident was to nearby cars, with several small fires that were quickly put out. Police made 14 arrests in the immediate aftermath (Miller, 2008).

The most destructive riot since the 1990s occurred in December 2011 after the firing of Penn State's football coach Joe Paterno. Thousands of students rioted, causing an estimated $190,000 in property damage and 38 people were charged with participating in the destructive behavior (Ganim, 2011).

Figure 4.3.14-1: Riot at Penn State University in December 2011 (Penn State University, 2015a)

A large fraction of police force duties involves the monitoring of drinking and drinking-related activities near the campus. There are about 60 incidents, which include underage drinking, disorderly conduct, and public drunkenness, on the average football game day.

Between 2015 and 2017 there were a series of protests held at the County Courthouse in Bellefonte Borough, also the location of the County Administrative Building. Demonstrators claimed there were accounts of corruption through forgery and inappropriate conduct between court officials. Protests remained peaceful with picketers returning to the same place to demonstrate (Falce, 2017).

Figure 4.3.14-2: Demonstration in support of the Black Lives Matter movement in June, 2020 (Centre Daily Times, 2020)

In late May 2020, an uprising against racism and police brutality swept the nation. Triggered by the murder of George Floyd by Minneapolis Police in Minnesota, groups in cities and towns across the country hosted protests for several weeks, including Centre County. The 3/20 Coalition was formed in 2019 after a State College resident, Osaze Osagie, was fatally shot by police. Having experienced a similar tragedy to the one in Minnesota, the State College community held their own demonstrations (Hogge, 2020). Protests were held in State College, Bellefonte, and Philipsburg Boroughs, some with hundreds of attendees. Public demonstrations spanned several weeks of summer 2020, despite threat of the COVID-19 pandemic.

Police protests have been largely non-violent in Centre County, employing tactics like blocking traffic but avoiding property damage (Centre Daily Times, 2020). Nationwide events can be unprecedented and difficult to predict. However, after actions begin authorities can expect them to continue and prepare for upcoming events. Events are ongoing at the time of this plan.

4.3.14.4 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. Therefore, the probability of civil disturbance occurring in Centre County is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.14.5 Vulnerability Assessment

Centre County is most vulnerable to civil disturbance events in three communities; Benner Township, College Township, and State College Borough. However, response training and anticipation to disturbances have diminished associated impacts and damages. Following the events of the Arts Fest Riot in 1998, the State College Police brought in a riot control expert and invested in riot gear and special training. This greatly increased the response capability and ability to more rapidly diffuse situations. Steps have also been taken along the 'Beaver Canyon' stretch in State College. Video surveillance has been added in key intersections as a deterrent. Officials continue to work with residents to discourage throwing items off balconies, and to address the vulnerabilities in the area. Both SCI's Rockview and Benner maintain disturbance response plans. There are mutual aid agreements between the County's police agencies, Penn State University, and the SCIs to assist one another and supply resources to respond to civil disorders. These include agreements of support from external agencies such as community emergency services, State Police, and the National Guard.

Jurisdictional losses for civil disturbance events are difficult to predict and can vary significantly in range. For example, the State College Riot in July 1998, fueled by alcohol consumption, resulted in approximately $150,000 in damages. The three 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 my occur. Failure to pursue a program of civil disturbance awareness may result in increased loss of lives and property.

4.3.15 Cyber Terrorism

4.3.15.1 Location and Extent

Cyber terrorism is a broad term that refers to acts associated with the convergence of terrorism and cyberspace. Generally, cyberterrorism involves unlawful attacks or threats against computers, networks, and the information stored therein to intimidate or coerce a government or its people to achieve political or social objectives (Denning, 2000). These acts can range from taking control of a host website, to using networked resources to directly cause destruction and harm. Table 4.3.1.15-1 includes the types and methods of cyberattacks as defined by the Pennsylvania Department of Homeland Security (PA DHS).

Table 4.3.15-1: Methods of Cyberattacks (PA DHS, 2017)

THREAT	DESCRIPTION
Botnet (also zombies)	A collection of computers subject to control by an outside party, usually without the knowledge of the owners, using secretly installed software robots. The robots are spread by trojan horses and viruses. The botnets can be used to launch denial-of-service attacks and transmit spam.
Card Skimming	The act of using a skimmer to illegally collect data from the magnetic stripe of a credit, debit or ATM card. This information, copied onto another blank card's magnetic stripe, is then used by an identity thief to make purchases or withdraw cash in the name of the actual account holder. Skimming can take place at an ATM and can occur at restaurants, taxis, or other places where a user surrenders his or her card to an employee.
Denial-of-Service Attack	Flooding the networks or servers of individuals or organizations with false data requests so they are unable to respond to requests from legitimate users.
Malicious Code (also malware)	Any code that can be used to attack a computer by spreading viruses, crashing networks, gathering intelligence, corrupting data, distributing misinformation and interfering with normal operations.
Pharming	The act of sending an e-mail to a user falsely claiming to be an established legitimate enterprise to scam the user into surrendering private information that will be used for identity theft. The e-mail directs the user to visit a website where they are asked to update personal information, such as passwords and credit card, social security, and bank account numbers that the legitimate organization already has. The website, however, is bogus and set up only to steal the user's information.

Table 4.3.15-1: Methods of Cyberattacks (PA DHS, 2017)

THREAT	DESCRIPTION
Phishing	Using fake e-mail to trick individuals into revealing personal information, such as Social Security numbers, debit and credit card account numbers and passwords, for nefarious uses.
Spam	Unsolicited bulk e-mail that may contain malicious software. Spam is now said to account for around 81 percent of all e-mail traffic.
Spear Phishing	A type of phishing attack that focuses on a single user or department within an organization, addressed from someone within the company in a position of trust and requesting information such as login IDs and passwords. Spear phishing scams will often appear to be from a company's own human resources or technical support divisions and may ask employees to update their username and passwords. Once hackers get this data, they can gain entry into secured networks. Another type of spear phishing attack will ask users to click on a link, which deploys spyware that can thieve data.
Spoofing	Making a message or transaction appear to come from a source other than the originator.
Spyware	Software that collects information without a user`s knowledge and transfers it to a third party.
Trojan Horse	A destructive program that masquerades as a benign application. Unlike viruses, Trojan horses do not replicate themselves, but they can be just as destructive. One of the most insidious types of Trojan horse is a program that claims to rid your computer of viruses but instead introduces viruses onto your computer.
Virus	A program designed to degrade service, cause inexplicable symptoms or damage networks.
Worm	Program or algorithm that replicates itself over a computer network and usually performs malicious actions, such as using up the computer's resources and possibly shutting the system down. A worm, unlike a virus, has the capability to travel without human action and does not need to be attached to another file or program.

Cyberattacks may not always constitute acts of cyberterrorism because some acts may have relatively small impacts and only produce annoyances. A cyberattack is generally considered an act of cyberterrorism when the following motivations are present:

- Effects-based: When computer attacks result in effects that are disruptive enough to generate fear comparable to a traditional act of terrorism.
- Intent-based: When unlawful or politically motivated computer attacks are done to intimidate or coerce a government or people to further a political objective, or to cause grave harm or severe economic damage (Rollins and Wilson, 2007).

Cyberattacks can be further divided into the following categories based on the complexity of the attack:

- Simple-Unstructured: Simple-unstructured attacks are the most common. These are amateurish attacks with relatively minimal consequences.
- Advanced-Structured: Advanced-structured attacks are more sophisticated and consequential and have a greater emphasis on targeting victims prior to an attack, resulting in a more debilitating effect.
- Complex-Coordinated: Complex-coordinated attacks are the most advanced and most troublesome type of attacks where success could mean a network shutdown (Denning, 2000).

Cyber terrorism can cause severe disruptions to transportation, public safety, and utility services, all of which are critical infrastructure that are highly dependent on information technology. Cyber terrorism can take many forms, including attacks through physical means, electronic means, and use of malicious code. Cyber terrorists can also have a wide range of personal, political, or cultural agendas. All state agencies, as well as individuals, businesses, and other institutions in Centre County, are potential targets for cyberterrorism. Potential threats include identity theft, loss of sensitive information, disruption of services, and other malicious activity.

Cyber terrorists can be difficult to identify because the internet provides a meeting place for individuals from various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. Cyberattacks are also unpredictable and typically occur without warning.

4.3.15.2 Range of Magnitude

In recent years, cyber terrorism has become a significant threat and can impact people, businesses, institutions, local governments, and state agencies to varying degrees. Impacts from a large-scale cyberterrorism event could disrupt the state's economy and potentially threaten its economic stability. The magnitude of a cyber terrorism attack will vary greatly based on the extent of systems affected and duration of the impact. Additionally, the magnitude will vary based upon which specific system is affected by an attack, the ability to preempt an attack, and an attack's effect on continuity of operations. The largest threat to institutions from cyber terrorism comes from any processes that are networked and controlled via computer. The county and individual municipalities should address and take measures to reduce any vulnerabilities that could allow access to sensitive data or processes.

4.3.15.3 Past Occurrence

Penn State University guards against and repels cyber threats every day. In 2015, the University discovered cyberattacks to both the Colleges of Engineering and Liberal Arts (Penn State News, 2015). FireEye, a cybersecurity forensic unit with Mandiant, was hired for remediation. Remediation refers to post cyberattack assessments made to determine what parts of the network are infected and need fixing.

It was determined that these were sophisticated cyberattacks conducted with advanced malware. The attacks exposed thousands of passwords and other Personal Identification Information (PII). It was also determined that the earliest dates of intrusion were in 2012. The networks were taken offline for several days to find and remove malware. All students and faculty were asked to reset their passwords. There have been no significant attacks on the University in recent years.

In 2018, Centre County was subject to a series of cyberattacks. An attack in late August caused a disruption in service to systems under the county data network. Investigation by County's cybersecurity and IT network managing company identified encryption malware commonly known as ransomware. The variant was not found to have functionality to access of exfiltrate data, encrypt files, use encryption for financial gain, or take over command and control. The intent of this attack appeared to be the destruction of data. PPI does not appear to have been accessed, viewed, or acquired. During the planning process, Bellefonte Borough noted that the community also experienced a cyberattack around this time that resulted in a two-week network shutdown.

In early September 2020, the County was subject to another attack. This ransomware attempted to encrypt data for financial gain, and successfully encrypted a series of files on the system. Investigations did not find evidence that any PII was accessed, viewed, or acquired in this incident. Following both County incidents, the County's cybersecurity partner implemented additional security measures, and worked with external experts to review the networks security.

Since 2012, there have been two statewide cyberterrorism related incidents reported to PEMA-KC. In 2017 there was an international cyber-attack, and in 2018 there was a statewide cyber incident. There were also cyber threats and attacks in other Pennsylvania Counties, including York in 2016, Northampton and Bethlehem in 2017, and Luzerne County in June 2019.

Another large-scale attack was the Equifax data breach in 2017, which was estimated to potentially impact over 5.5 million residents of Pennsylvania and over 145.5 million nationally. The information accessed included names, Social Security numbers, birthdates, addresses, and driver's license numbers (PA Office of the Attorney General, 2017). Additionally, in 2014 the largest data breach in history impacted over 3 billion Yahoo user accounts, including the names, email address, date of birth, and telephone numbers of over 500 million users (CSO, 2018). In terms of a data breach cyber-attack, this could be considered a worst-case scenario event. Large-scale data breach events are becoming more common.

In addition to large-scale acts of cyber terrorism, smaller cyberattacks occur daily. Billions of emails are sent each day, and spam and phishing emails account for a significant share of all email traffic. Additionally, brute force attacks, which are trial and error attempts to obtain user passwords and pins, are frequently used by criminals attempting to crack encrypted data or gain access to private accounts. Firewalls can be effective at keeping security threats such as these out, but once a cybercriminal gains access to a system, they can attack from within. For example, gaining access to a state employees email account would allow a hacker to send additional

phishing emails from within a network, which may not be as monitored as closely as attacks from outside the system. This is known as spear phishing.

4.3.15.4 Future Occurrence

Cyber terrorism is an emerging hazard that has the potential to impact the County's computer infrastructure and the systems and services that are provided to the public. Concerns about cyberterrorism throughout the United States is growing as its impacts could have potentially crippling effects. Security experts describe the threat of cyberterrorism as imminent. The future occurrence of cyberterrorism can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

Penn State University hosts several programs related to homeland security. Cybersecurity experts at this anchor institution could be an important partner for the County in both responding to and preventing cyberattacks. Centre County Information Technology Services website details mitigation tactics that individuals and business owners can take to prevent breaches in cybersecurity, including tips for creating passwords ways to stay safe in the workplace (Centre County, 2020b).

4.3.15.5 Vulnerability Assessment

Generally, cyber terrorism has no direct effect on the environment; however, the environment may be affected if a hazardous materials release occurred because of critical infrastructure failure as a result of cyber terrorism. Similarly, an act of cyber terrorism on a nuclear facility could have devastating environmental consequences if the plant suffered an intentional catastrophic failure. Please see Section 4.3.17 for more information on Hazardous Materials Release.

All county and municipal facilities are vulnerable to cyber terrorism. While the physical structures of these buildings are generally not at risk, information systems and data stored within them are vulnerable. Government computer networks contain sensitive information that is integral to the security of the Commonwealth and could be the target of a cyberattack. County and municipal governments may also possess and maintain forms of personal and financial information, including tax filings, birth and death records, Social Security numbers, medical information, and more. Additionally, many critical facilities that are essential to Centre County operations are reliant upon computer networks to monitor and control critical functions. For example, an attack on internet access or the power grid could have detrimental impacts on County services and functions. Additionally, a large-scale computer breach could lead to economic costs in lost productivity to the impacted agency/organization and potentially related businesses and industries. However, lost revenues and productivity would depend on the type of magnitude of the cyber terrorism event.

All communities in Centre County are vulnerable on some level, directly or indirectly, to a cyber terrorism attack. However, in general, areas with higher concentrations of government or industry facilities may have higher risk. Additionally, areas with higher concentrations of people, businesses, and critical infrastructure may be at higher risk.

4.3.16 Dam Failure

The Dam Failure profile can be found in Appendix G.

4.3.17 Environmental Hazards – Hazardous Material Release

4.3.17.1 Location and Extent

Hazardous material releases pose threats to the natural environment, the built environment, and public safety through the diffusion of harmful substances, materials, or products. Hazardous materials can include toxic chemicals, infectious substances, bio-hazardous waste, and any materials that are explosive, corrosive, flammable, or radioactive. Hazardous material releases can occur wherever hazardous materials are manufactured, used, stored, or transported. Such releases can occur along transportation routes or at fixed-site facilities. Hazardous material releases can result in human and wildlife injury, property damage, and contamination of air, water, and soils.

Fixed-site facilities that use, manufacture, or store hazardous materials in Centre County pose significant risk and must comply with both Title III of the federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act, and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. These statutes require that all owners or operators of facilities that manufacture, produce, use, import, export, store, supply, or distribute any extremely hazardous substance, as defined by the EPA, at or above the threshold planning quantity, shall report to the county where the facility is located and the Commonwealth. These facilities are subject to the requirement of assisting the Local Emergency Planning Committee (LEPC) in the development of an Off-site Emergency Response Plan (UA EPA, 2020a). The right-to-know reporting requirements keep communities abreast of the presence and release of chemicals at individual facilities. The EPA also tracks key information about chemicals handled by industrial facilities through its Toxics Release Inventory (TRI) database. Facilities which employ ten or more full-time employees, and which manufacture or process 25,000 pounds or more, or otherwise use 10,000 pounds or more, of any SARA Section 313-listed toxic chemical in the course of a calendar year are required to report TRI information to the EPA and PEMA. In 2019, there were 3,067 tracked facilities on EPA's TRI in Pennsylvania, 26 of which are located in Centre County as shown in Figure 4.3.17-1.

Figure 4.3.17-1: Locations Toxic Release Inventory (TRI) Facilities in Centre County, 2019

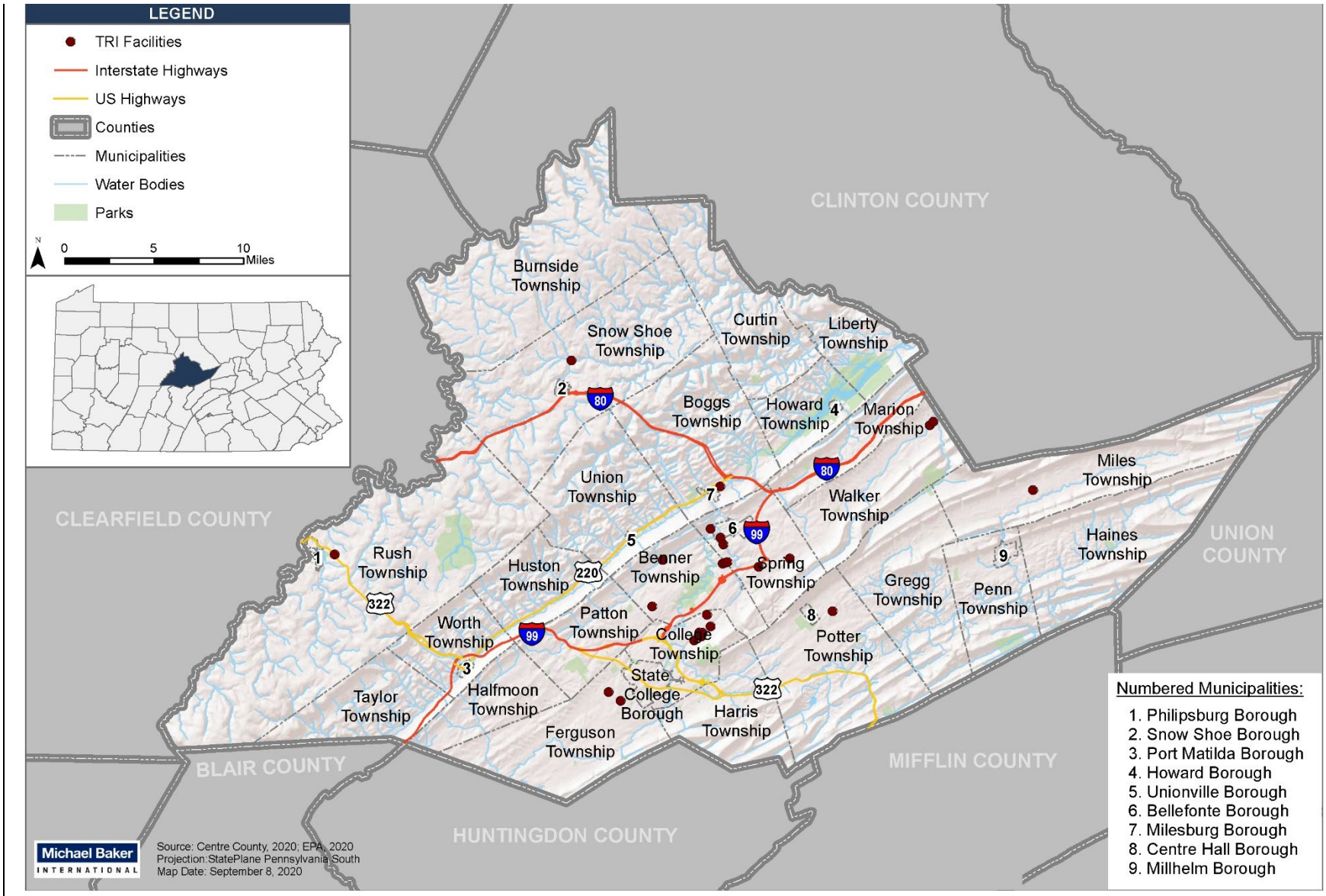


Table 4.3.17-1 shows the number of TRI facilities in Centre County by municipality. Of the 35 municipalities in Centre County, 11 contain a TRI facility. College Township and Spring Township are home to the most TRI sites in the County with five or more TRI sites each.

Table 4.3.17-1: TRI Facilities in Centre County

TRI FACILITY	ADDRESS	MUNICIPALITY
PIEZO KINETICS/BELLEFONTE PLT	145 MILL STREET	Bellefonte
RESTEK CORP/BELLEFONTE PLT	110 BENNER CIRCLE	Benner
STATE OF THE ART/STATE COLLEGE PLT	2470 FOX HILL ROAD	Benner
THERMO FISHER SCIENTIFIC	320 ROLLING RIDGE DR	Benner
CON LIME INC/BELLEFONTE	590 LOWER GYP RD	Benner
HILEX POLY CO LLC	606 OLD CURTIN ROAD	Boggs
MG INDUSTRIES	1348 BENNER PIKE	College
RUETGERS ORGANICS CO/STATE COLLEGE	201 STRUBLE ROAD	College
ALLTECH ASSOCIATES INC. DBA ALLTEC	2701 CAROLEAN INDL. D	College
TRS TECHNOLOGIES	2820 EAST COLLEGE AVE	College
GENERAL DYNAMICS	60 DECIBEL RD SUITE 2	College
C-COR NET	60 DECIBEL ROAD	College
Dale Summit LLC	ROUTE 26	College
SPECTRUM CONTROL TECHNOLOGY INC	1900 WEST COLLEGE AVE	Ferguson
CHEMCUT HOLDINGS LLC	500 SCIENCE PARK ROAD	Ferguson
MONTOUR OIL	107 W MAIN ST	Miles
HANOVER FOODS CORP	RTE. 45	Potter
PMG PENNSYLVANIA CORP	187 ENTERPRISE DR	Rush
SNOW SHOE REFRACTORIES LLC/CLARENC	895 CLARENCE RD	Snow Shoe
SUPELCO/BELLEFONTE PLT	595 NORTH HARRISON RO	Spring
PIEZO KINETICS	660 ROLLING RIDGE DR	Spring
GRAYMONT INDUSTRIES	965 EAST COLLEGE AVE	Spring
GRAYMONT (PA) INC.	NORTH THOMAS STREET	Spring
NAVITUS LLC	ROUTE 144 SOUTH	Spring
SUPERIOR PLUS ENERGY-HOWARD	4231 NITTANY VALLEY D	Walker

Due to the sensitive nature of SARA facility information, Centre County will not provide a detailed account of SARA facilities for this plan. This information may be requested in writing to the Centre County LEPC Chairman, 420 Holmes Street, Bellefonte, PA 16823. However, some notable facilities that report through the EPA TRI process include:

- Hanover Foods Corp, Potter Township: Supplier of frozen food products. The company was responsible for 45 percent of Centre County releases listed in 2019 releasing 11,230 pounds of ammonia (EPA, 2020b).
- Piezo Kinetics, Spring Township: Manufactures piezoelectric ceramic elements that are used by the aerospace and biomedical industries and in items such as sound boards, dental equipment, and even fish finders. In 2019, this company was responsible for 42

percent of Centre County releases. Piezo Kinetics had no on-site toxic releases but used a solidification or stabilization process to capture 10,580 pounds of lead compounds and send them off-site (EPA, 2020b).

In addition to fixed-site hazardous materials release, 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. 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.

A number of major highways can be used in Centre County for the transport of hazardous materials including I-80, I-99, US-220, US-322, PA-26, PA-144, PA-164, and PA-550. Centre County has 584.5 linear miles of roadway according to PennDOT's 2019 Pennsylvania Highway Statistics Report (PennDOT, 2019b). Additionally, many of these roads cross rivers and streams and travel through downtown and residential areas, increasing the potential to pollute surface water and groundwater and cause harm to life and property.

The Centre County OES developed a Hazards Materials Commodity Flow Study in 2011. This remains the most current commodity flow study for the County. A component of this study was to conduct placard counts to examine the number and type of hazardous materials transported on selected highways in Centre County. The results of these counts are shown in Table 4.3.17-2. I-80, I-99, US-220, and US-322 are highly traveled by vehicles transporting hazardous materials. While not observed during the study, I-80 is currently used to transport nuclear waste. PA-26, 64, 144, and 550 are also vulnerable to accidents involving hazardous materials. As hazardous materials shipments on these roadways continue to increase, it is not only likely transportation accidents involving hazardous materials will continue to occur in Centre County; they could increase in number and magnitude.

The risk of transportation-related hazardous material incidents is also heightened by the installation of high-speed rails through Bald Eagle Valley, increasing air traffic over Centre County, and continuing expansion of University Park Airport. Several railroad accidents have occurred in Pennsylvania involving hazardous materials (NTSB, 2020), though none in Centre County. 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. Additional hazardous materials are contained at the military installations within Pennsylvania. Nuclear facilities are another type of fixed-facility that poses risk of hazard material release. For more information about nuclear incidents, reference Section 4.3.20.

Table 4.3.17-2: Centre County Hazard Materials Commodity Flows, 2011

LOCATION	EXPLOSIVES		GASES		FLAMM-ABLE LIQUIDS		FLAMM-ABLE SOLIDS		OXIDE/ PEROXIDE		TOXIC/ POISON		RADIOACTIVE		CORROSIVE		MISC.		DANGEROUS	
	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011
SR 879 Pine Glen	---	0	---	0	---	2	---	0	---	0	---	0	---	0	---	0	---	0	---	0
I-99 Port Matilda	1	5	1	18	8	25	0	6	0	10	0	5	0	1	1	2	1	16	1	1
I-80 WB Snow Shoe Rest Stop	2	0	2	6	33	27	5	1	6	0	2	0	0	0	14	8	17	2	6	4
I-80 EB Snow Shoe Rest Stop	1	1	7	12	12	15	1	0	3	2	1	3	0	0	5	7	5	6	1	0
SR 64 Zion	---	0	---	9	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0
I-99/SR 220 NB Shiloh Road	2	0	1	2	5	6	0	0	1	1	0	0	0	0	1	0	0	3	0	2
US 26 Pine Grove Mills	0	0	1	2	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
US 220/US 322 Port Matilda	0	1	0	2	2	6	0	0	0	0	0	0	0	0	2	2	0	0	1	0
SR 350/US 322 Philipsburg	0	2	1	1	24	14	0	0	0	1	3	0	0	0	7	0	0	3	0	0
SR 144 Snow Shoe Rest Stop (AM)	---	1	---	1	---	4	---	0	---	0	---	0	---	0	---	0	---	0	---	0

Table 4.3.17-2: Centre County Hazard Materials Commodity Flows, 2011

LOCATION	EXPLOSIVES		GASES		FLAMM-ABLE LIQUIDS		FLAMM-ABLE SOLIDS		OXIDE/ PEROXIDE		TOXIC/ POISON		RADIOACTIVE		CORROSIVE		MISC.		DANGEROUS	
	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011	2009	2011
SR 144 Snow Shoe Rest Stop (PM)	---	0	---	1	---	3	---	0	---	0	---	0	---	0	---	0	---	0	---	0
SR 45/SR 144 Potter Township	---	0	---	1	---	3	---	0	---	0	---	0	---	0	---	0	---	0	---	0
SR 192 Centre Hall	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0	---	0
SR 150 Milesburg	---	0	---	0	---	5	---	0	---	0	---	0	---	0	---	1	---	2	---	2
US 322/144 Penn Nursery	0	0	1	0	9	3	0	0	2	0	1	0	0	0	2	5	0	0	0	0
Totals	6	10	14	55	100	114	6	7	12	14	7	8	0	1	32	25	23	32	9	9

4.3.17.2 Range of Magnitude

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

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

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

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

A worst-case scenario event of a hazardous material release would be if a release occurred in the most populous jurisdiction, State College Borough. A hazardous material release would likely cause the evacuation of residents and the students and staff of Penn State University.

The environmental impacts of hazardous material releases include:

- Hydrologic effects – surface and groundwater contamination
- Other effects on water quality such as changes in water temperature
- Damage to streams, lakes, ponds, estuaries, and wetland ecosystems
- Air quality effects – pollutants, smoke, and dust
- Loss of quality in landscape
- Reduced soil quality
- Damage to plant communities – loss of biodiversity; damage to vegetation

- Damage to animal species – animal fatalities; degradation of wildlife and aquatic habitat; pollution of drinking water for wildlife; loss of biodiversity; disease.

4.3.17.3 Past Occurrence

The County's first large-scale, multi-municipality hazardous material response was to a multiple vehicle accident on I-80 on January 6, 2004. This accident occurred when a sudden snow squall caused the roadway to flash freeze and created whiteout conditions. A total of 47 vehicles, 30 of which were tractor trailers, crashed, killing six and injuring at least 11 people who required emergency medical transport. One tractor trailer, located at the center of the accident, was carrying 80 drums of hazardous waste. The situation was further complicated by frigid temperatures. A total of 84 emergency response agencies from Centre County and seven other counties responded.

Between January 2015 and December 2020, across the Commonwealth, there were 5,064 highway and railway related hazardous material incidents (PHMSA, 2020). Other prior year incident information for Pennsylvania can be found on the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration website. Specifically, in Centre County, there were 71 highway and railway related hazardous materials incidents.

Since the passage of SARA, Title III facilities which produce, use, or store hazardous chemicals must notify the public through the county emergency dispatch center and PEMA if an accidental release of a hazardous substance meets or exceeds a designated reportable quantity, and affects or has the potential to affect persons and/or the environment outside the plant. SARA Title III and Pennsylvania Act 165 also require a written follow-up report to PEMA and the County. These written follow-up reports include any known or anticipated health risks associated with the release and actions to be taken to mitigate potential future incidents. In addition, Section 204(a) (10) of Act 165 requires PEMA to staff and operate a 24-hour State Emergency Operations Center (SEOC) to provide effective emergency response coordination. The Pennsylvania's Hazardous Material Emergency Planning and Response Act 990-165 - 2018 Annual Report states there were 2,252 hazardous materials/petroleum incidents in Pennsylvania and six of these events occurred in Centre County (PEMA, 2018a). Additional incident information for years prior to 2018 may be obtained from annual reports submitted to PEMA.

Since beginning in January 1989, 174 hazardous material release events were identified in Centre County OES's incident log, 31 of which were related to petroleum incidents. While this is not a comprehensive source of all incidents in Centre County, it provides an inventory of events with which OES has been involved. Table 4.3.17-3 shows a detailed summary of events recorded in the past 10 years, since 2010. The largest recent hazardous material release occurred in October 2020, when a crew in Bellefonte Borough struck an unmarked natural gas line. This resulted in the evacuation of residents and closure of businesses within a one-mile radius of the leak. This included the Centre County Courthouse, Annex, and Sheriff's Office. Evacuations were assisted by multiple law enforcement agencies and fire companies. The leak was reported at 11:20 AM and the evacuation was lifted at 1:00 PM.

Figure 4.3.17-3: Hazardous Materials Releases in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
10/25/2010	Hazmat	Chemical Explosion	Materials Research Lab, Up, State College Borough
10/25/2010	Hazmat	Gas Explosion	Psu,236 Materials Research Lab, State College Borough
4/15/2011	Hazmat	Vehicle Accident	I-99 @ Shiloh, Benner Twp
9/6/2011	Hazmat	Sulfuric Acid Spill	554 Hillcrest Ave, State College
11/19/2011	Hazmat	Chemical Spill	Restek Inc, Spring Twp
12/8/2011	Hazmat	Chemical Spill	Electrical Engineering East Building
5/28/2012	Hazmat	Gasoline Spill (Hose Burst)	Lykens Market, Bellefonte Borough
6/6/2012	Hazmat	Fuel Spill	I-80 Near 165 1/2 Mile Marker
8/25/2012	Hazmat	Cooking Oil Spill	I-80, Near Exit 158
5/19/2014	Hazmat	Pesticide Spill	Rte. 322, Potters Mills, Potter Twp.
4/19/2015	Hazmat	Chemical Spill	Millennial Science Complex Off Pollock Rd, State College Boro
5/10/2015	Hazmat	Ammonia Release	Hanover Foods, Potter Twp
2/22/2015	Hazmat	Chemical Spill	Millennial Science Complex off Pollock Rd, State College Borough
4/19/2015	Hazmat	Ammonia Release	Hanover Foods, Potter Township
7/14/2015	Hazmat	Chemical Spill	1009 Taylor St., State College Borough
7/31/2015	Hazmat	Hazmat Tanker Fire	T & A Truck Stop, Boggs Twp.
9/9/2015	Gas leak	Ruptured Gas Line	College Ave. Pleasant Gap, Spring Township
6/16/2016	Hazmat	Tractor Trailer Fuel Leak	Milesburg McDonald's, Boggs Township
3/3/2017	Hazmat	Mercury from Thermometer	450 Robinson Lane, Benner Township
3/3/2017	Hazmat	Hydraulic Fluid Spill	Rte 64 & Fiedler Rd, Spring Township
5/28/2017	Hazmat	CHLORINE LEAK (Hypochlorite Solution-5% Chlorine)	Kepler Pool, Governors' Park Rd, Spring Township
3/13/2018	Hazmat	Residential Heating Oil Spill, Small Quantity	Mt. Eagle, Howard Township
8/31/2018	Hazmat	Report of Oil Sheen, In Flood Waters, NRC#1224205	Port Matilda Boro Intersection
3/11/2019	Hazmat	Came Through NRC, Reported Release of Ammonia	Hanover Foods, Sr 45, Potter Township
6/12/2019	Hazmat	Heating Oil Spill, Contained to Basement	102 Fountain Road, Snow Shoe Township
6/18/2019	Hazmat	Fuel Oil Spill, 100 Plus Gallons	Sr 350, Presque Isle St. Philipsburg Borough
7/24/2019	Hazmat	Propane Release from Amerigas	Amerigas, Axeman, Sr 144, Spring Township

Figure 4.3.17-3: Hazardous Materials Releases in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
1/24/2020	Hazmat/ Sheltering	Natural Gas Leak, Residents Evacuated	Park Avenue, Spring Township
4/29/2020	Hazmat	Suspected medical waste dumped	SR 45, Potter Township
8/1/2020	Hazmat – Gas release	Vehicle struck three 200 lb. propane tanks	Village of Boalksburg, Harris Township
8/18/2020	Hazmat	Home heating oil tank leak	Fowler Hollow Road, Taylor Township
9/27/2020	Hazmat	Fuel leak from boat into lake	Marina, Bald Eagle State Park
10/16/2020	Hazmat – Gas release	Major gas line struck, entire town evacuated	Bellefonte Borough
11/22/2020	Hazmat – Gas release	Unknown source – possibly release from outside	E. Mountain Road, Worth Township
12/11/2020	Hazmat – Gas release	Leak at Hawbakers Tank Farm	Pleasant Gap, Spring Township

Table 4.3.17-4 shows the number of hazardous materials release events in the Centre County OES log by year since1989. As shown, reported incidents spiked during 1995-1997.

There are additional concerns in Centre County related to sulfuric acid runoff from the Skytop highway cut through Bald Eagle Mountain (Township of Patton), which was created during I-99 construction in 2003. The exposure of large quantities of Iron Pyrite have resulted in a reaction with the iron sulfide present in the mineral and outside oxygen which in turn produces sulfuric acid and is damaging when this acid is present in appreciable quantities, mixes with rainwater and washes into the local watershed and drainage system. During construction of I-99, more than a million cubic yards of acid rock (the term being used for rock piles composed significantly of pyrite), which had been safely embedded in geologic formations for millions of years, have been dug up and exposed. The resulting acid has leaked primarily into Buffalo Run, an official "high quality" stream that runs through the valley immediately to the east of Bald Eagle Ridge, and eventually to Spring Creek and the West Branch of the Susquehanna River. Ultimately, a remediation effort (2006-2008) was undertaken to transfer

Table 4.3.17-4: Hazardous Materials Release Events in Centre County (Centre County EMA, 2021)

YEAR	EVENTS
1989	5
1990	7
1991	6
1992	4
1993	8
1994	7
1995	13
1996	12
1997	17
1998	4
1999	5
2000	3
2001	8
2002	8
2003	4
2004	6
2005	4
2006	5
2007	3
2008	5

and encase such rock, currently held in an Engineered Rock Placement Area alongside Interstate 99 a mile east of Port Matilda. DEP has since characterized the quality of groundwater in the Skytop area as stable, but it has been noted that a slight increase in sulfates in some home wells has been detected (2009), generally around the crossroads of North Atherton Street and state Route 550, downhill from Skytop.

YEAR	EVENTS
2009	7
2010	2
2011	4
2012	3
2013	0
2014	1
2015	7
2016	1
2017	3
2018	2
2019	4
2020	7
2021	1
Total	174

4.3.17.4 Future Occurrence

While many hazardous material release incidents have occurred in Centre County in the past, they are generally considered difficult to predict. An occurrence is largely dependent upon the accidental or intentional actions of a person or group. Intentional acts are addressed under Section 4.3.22, Terrorism.

For transportation-related hazardous material release incidents, an ongoing series of Hazardous Materials Commodity Flow Studies conducted in 2005, 2007, 2009, and 2011 have identified the most frequently shipped hazardous materials within Centre County. The count in 2009 was found consistent with other findings, namely that flammable liquid is the most counted placard, followed by corrosives. Historically, shipments of these two hazardous materials comprise 43 percent and 16 percent, respectively, of all shipments surveyed. In 2009, at 8 survey locations in mid-June, a total of 16,511 vehicles, 3,558 trucks, and 199 placarded trucks were observed. Sample location identified for the highway movement of hazardous materials included:

- US 322/SR 350 in Philipsburg
- US 322/SR220 in Port Matilda
- US 26 in Pine Grove Mills
- US 220/I-99 at Shiloh Road in College Township
- US 322 at Penn Nursery in Potter Township
- I-99 Between Port Matilda and Blair County
- I-80 Snow Shoe Eastbound
- I-80 Show Shoe Westbound

A total of 86 municipal waste trucks were also observed during the three- to four-hour observation window during the 2009 commodity flow study. While no shipments placarded as radioactive were observed, there have been and continue to be, infrequent radioactive shipments throughout the County. New traffic patterns have decreased truck counts at US 322/SR 220, due to the complete opening of I-99 for travel southbound out of State College in fall 2008.

The 2011 Hazardous Materials Commodity Flow Study examined 15 selected highways throughout Centre County. At these 15 locations, 275 placarded trucks were recorded. Flammable liquids remained the most commonly counted placard, as shown in Table 4.3.16-1. Gases, miscellaneous hazardous materials, and corrosives were the next most common. Unlike in 2009, one vehicle carrying radioactive materials was also recorded. The majority of placarded vehicles carrying hazardous materials were observed on I-99 in Port Matilda (89 vehicles), followed by I-80 westbound at the Snow Shoe Township rest stop (48 vehicles), and I-80 eastbound at the Snow Shoe Township rest stop (46 vehicles).

Shifting traffic patterns and the presence of a multitude of hazardous materials in transit through the county, however, still warrants the need for continued development of response capability, which has been an ongoing priority for the Centre County OES, the Centre County Local Emergency Planning Committee and the County's fire, hazmat, EMS and police agencies.

The probability of future hazardous materials release events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.17.5 Vulnerability Assessment

Jurisdictions that are home to one or more hazardous materials facilities should be considered vulnerable to hazardous materials releases from fixed facilities. Structures, critical facilities, and populations located near hazardous material areas are also at risk. Table 4.3.17-5 shows the total number of structures in hazardous materials hazard areas defined as a 1.5-mile radius from any TRI facility. More than 50 percent of Centre County's municipalities have structures within hazardous materials hazard area. A number of municipalities are more at risk than others with higher percentages of structures within hazardous materials hazard areas including the Milesburg Borough (100 percent), Bellefonte Borough (88 percent), Spring Township (85 percent), and Centre Hall Borough (83 percent).

Table 4.3.17-5: Structures Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT STRUCTURES IN HAZARDOUS MATERIAL HAZARD AREA
Bellefonte Borough	2,658	2,352	88%
Benner Township	2,369	1,803	76%
Boggs Township	1,598	588	37%
Burnside Township	41	-	0%
Centre Hall Borough	579	483	83%
College Township	4,810	2,719	57%
Curtin Township	448	-	0%
Ferguson Township	6,949	4,720	68%
Gregg Township	1,179	-	0%
Haines Township	1,003	-	0%
Halfmoon Township	1,089	-	0%

Table 4.3.17-5: Structures Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT STRUCTURES IN HAZARDOUS MATERIAL HAZARD AREA
Harris Township	2,798	-	0%
Howard Borough	298	-	0%
Howard Township	523	-	0%
Huston Township	684	-	0%
Liberty Township	1,233	-	0%
Marion Township	501	18	4%
Miles Township	944	371	39%
Milesburg Borough	475	475	100%
Millheim Borough	427	-	0%
Patton Township	5,315	460	9%
Penn Township	881	-	0%
Philipsburg Borough	1,309	679	52%
Port Matilda Borough	256	-	0%
Potter Township	2,015	377	19%
Rush Township	2,462	632	26%
Snow Shoe Borough	346	136	39%
Snow Shoe Township	1,347	468	35%
Spring Township	3,654	3,088	85%
State College Borough	6,861	1,708	25%
Taylor Township	497	-	0%
Union Township	775	13	2%
Unionville Borough	134	-	0%
Walker Township	2,038	353	17%
Worth Township	471	-	0%
Total	59,367	21,443	36%

Table 4.3.17-6 shows the total number of critical facilities in hazardous materials areas by municipality. Note that the critical facility analysis for hazardous material hazard areas does not include TRI facilities classified as a critical facility as these sites are those that define the hazard area in this analysis. More than 40 percent of Centre County's municipalities have critical facilities within hazardous materials hazard area. A number of municipalities are more at risk than others with higher percentages of critical facilities within hazardous materials areas including the Centre Hall and Milesburg Boroughs, both with 100 percent of critical facilities in these hazard areas. There are 23 day care centers located in areas vulnerable to hazardous materials release. This represents the biggest portion of critical facilities in these areas. Dams (5), personal care facilities (6), and water and sewer treatment plants (17) are also located in these areas. In the event of hazardous materials release, these facilities may be susceptible to water contamination.

Table 4.3.17-6: Critical Facilities Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT CRITICAL FACILITIES IN HAZARDOUS MATERIAL HAZARD AREA
Bellefonte Borough	16	16	94%
Benner Township	22	17	65%
Boggs Township	8	3	36%
Burnside Township	4	-	0%
Centre Hall Borough	4	4	100%
College Township	37	14	32%
Curtin Township	2	-	0%
Ferguson Township	25	16	64%
Gregg Township	10	-	0%
Haines Township	7	-	0%
Halfmoon Township	5	-	0%
Harris Township	8	-	0%
Howard Borough	4	-	0%
Howard Township	1	-	0%
Huston Township	1	-	0%
Liberty Township	6	-	0%
Marion Township	3	-	0%
Miles Township	14	7	47%
Milesburg Borough	3	3	100%
Millheim Borough	4	-	0%
Patton Township	22	1	5%
Penn Township	15	-	0%
Philipsburg Borough	9	5	56%
Port Matilda Borough	4	-	0%
Potter Township	14	3	21%
Rush Township	26	4	15%
Snow Shoe Borough	2	1	50%
Snow Shoe Township	7	1	13%
Spring Township	14	10	53%
State College Borough	36	7	19%
Taylor Township	1	-	0%
Union Township	5	-	0%
Unionville Borough	-	-	0%
Walker Township	12	1	8%

Table 4.3.17-6: Critical Facilities Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT CRITICAL FACILITIES IN HAZARDOUS MATERIAL HAZARD AREA
Worth Township	2	-	0%
Total	**363**	**113**	**31%**

Table 4.3.17-7 shows total conventional and unconventional oil and gas well in hazardous material hazard areas by municipality. Only one municipality has oil and gas wells in hazardous material hazard areas: Snow Shoe Township (31).

Table 4.3.17-7: Conventional and Unconventional Oil and Gas Wells Vulnerable to Hazardous Materials Release

MUNICIPALITY	TOTAL OIL AND GAS WELLS	OIL AND GAS WELLS IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT OIL AND GAS WELLS IN HAZARDOUS MATERIAL HAZARD AREA
Boggs Township	51	0	0%
Burnside Township	683	0	0%
Curtin Township	192	0	0%
Liberty Township	2	0	0%
Marion Township	1	0	0%
Rush Township	60	0	0%
Snow Shoe Township	615	31	5%
Taylor Township	2	0	0%
Union Township	7	0	0%
Worth Township	3	0	0%
Grand Total	**1,616**	**31**	**2%**

Table 4.3.17-8 shows the vulnerability of the County's population to hazardous material hazard areas. One percent of the County's population lives in hazardous material hazard areas, with most of these residents concentrated in Bellefonte Borough, Benner Township, College Township, Harris Township, Huston Township, Liberty Township, and Spring Township.

Table 4.3.17-8: Population Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL ESTIMATED 2010 POPULATION	TOTAL POPULATION IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT POPULATION IN HAZARDOUS MATERIAL HAZARD AREA
Bellefonte Borough	7,457	118	2%
Benner Township	1,928	168	9%
Boggs Township	1,951	-	0%
Burnside Township	864	-	0%

Table 4.3.17-8: Population Vulnerable to Hazardous Materials Release

MUNICIAPLITY	TOTAL ESTIMATED 2010 POPULATION	TOTAL POPULATION IN HAZARDOUS MATERIAL HAZARD AREA	PERCENT POPULATION IN HAZARDOUS MATERIAL HAZARD AREA
Centre Hall Borough	573	-	0%
College Township	8,126	117	1%
Curtin Township	1,227	-	0%
Ferguson Township	2,482	-	0%
Gregg Township	2,220	4	0%
Haines Township	1,137	-	0%
Halfmoon Township	2,608	-	0%
Harris Township	24,486	232	1%
Howard Borough	46,258	-	0%
Howard Township	1,853	-	0%
Huston Township	20,404	112	1%
Liberty Township	11,607	137	1%
Marion Township	907	-	0%
Miles Township	4,539	5	0%
Milesburg Borough	501	-	0%
Millheim Borough	1,953	-	0%
Patton Township	2,356	-	0%
Penn Township	2,558	66	3%
Philipsburg Borough	2,095	5	0%
Port Matilda Borough	1,128	-	0%
Potter Township	1,640	-	0%
Rush Township	3,911	-	0%
Snow Shoe Borough	1,177	-	0%
Snow Shoe Township	2,415	-	0%
Spring Township	4,954	168	3%
State College Borough	3,433	-	0%
Taylor Township	19,028	-	0%
Union Township	3,691	-	0%
Unionville Borough	5,525	56	1%
Walker Township	5,029	29	1%
Worth Township	5,598	-	0%
Total	207,619	1,217	1%

4.3.18 Environmental Hazards – Conventional Oil and Gas Wells

4.3.18.1 Location and Extent

Oil and gas development in Pennsylvania is extensive and has been ongoing for over 150 years, with the most recent phase of exploration and production activities targeting the Marcellus and Utica shales. Regulatory standards for the industry have evolved significantly as a function of both advances in technology and a more intense focus on environmental protection. More than 350,000 oil and gas wells have been drilled in Pennsylvania since the first commercial oil well was developed in 1859 (PA DEP-OOGM, 2010). Additionally, oil and gas development had been taking place for nearly a century prior to permitting requirements enacted in 1955, an estimated 100,000 to 560,000 abandoned wells are yet to be accounted for in the state (PA DEP, 2020c). PA DEP differentiates between conventional and unconventional oil and gas wells. Conventional wells are traditional vertical wells, while unconventional wells are typically horizontally drilled wells commonly associated with the Marcellus Shale. Unconventional gas wells are profiled in Section 4.3.19.

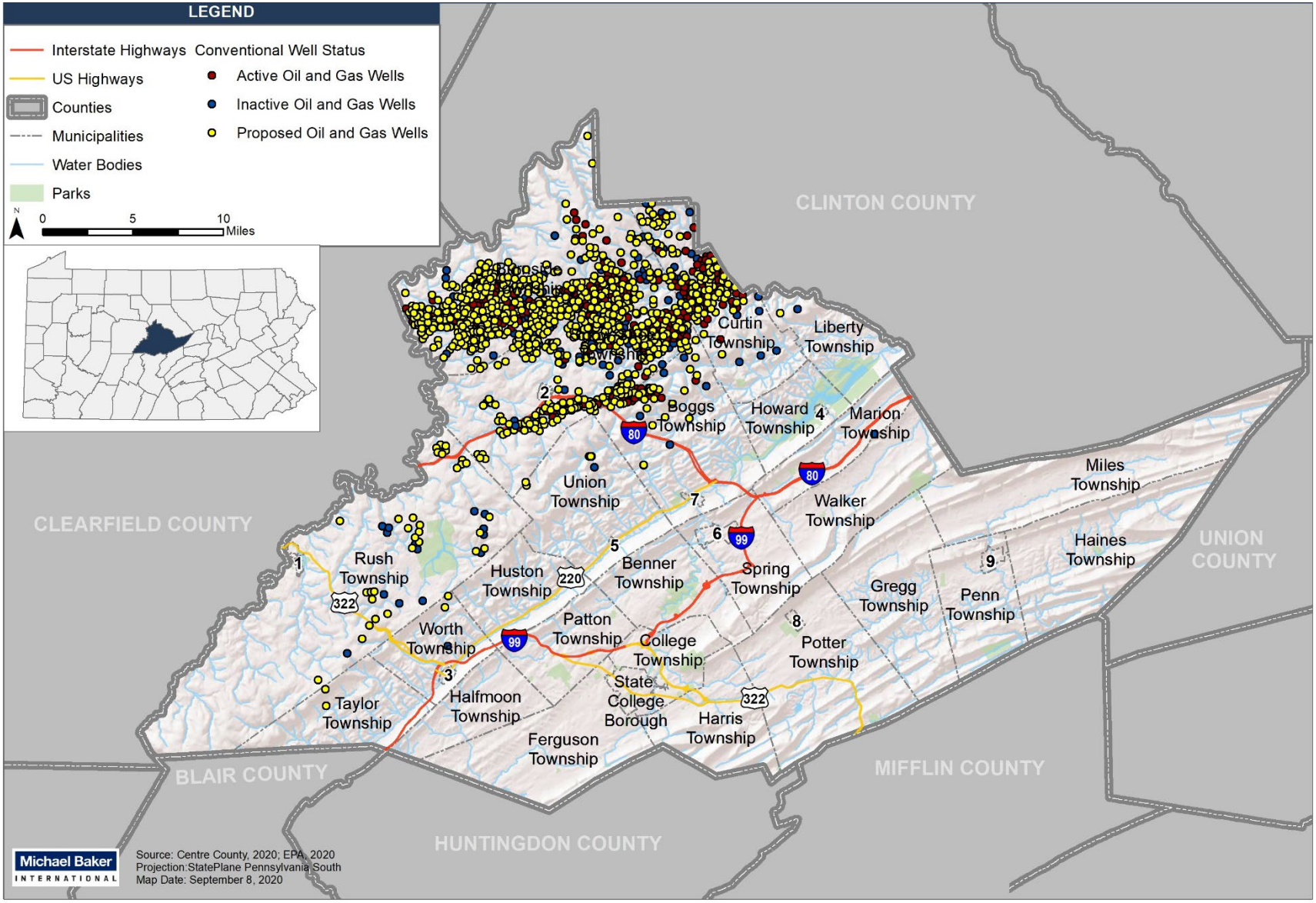
In Centre County, most wells are conventional. There are 705 active and 170 inactive conventional wells in the county. As shown in Figures 4.3.18-1, conventional oil and gas wells are located in the northwestern and western part of the County, mostly concentrated in Burnside, Snow Shoe, and Curtin Townships.

Private water supplies such as domestic drinking water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants including methane, which can pose a fire hazard. For more information on public and private water supplies, see Section 4.3.18.5.

4.3.18.2 Range of Magnitude

As is the case with all natural resource extraction, a variety of potential hazards exist with oil and gas extraction. Abandoned oil and gas wells that are not properly plugged can contaminate groundwater and consequently domestic drinking water wells. Surface waters and soil are sometimes polluted by brine, a salty wastewater product of oil and gas well drilling, and from oil spills occurring at the drilling site or from a pipeline breach. This can spoil public drinking water supplies and be particularly detrimental to vegetation and aquatic animals.

Figure 4.3.18-1: Conventional Oil and Gas Well Locations in Centre County



Methane can leak into domestic drinking wells and pose fire and explosion hazards. In addition, natural gas well fires can occur when natural gas is ignited at the well site. Often, these fires erupt during drilling when a spark from machinery or equipment ignites the gas. The initial explosion and resulting flames have the potential to seriously injure or kill individuals in the immediate area. These fires are often difficult to extinguish due to the intensity of the flame and the abundant fuel source. When methane gas from unplugged gas wells seeps into underground coal mines, miners are at risk of asphyxiation and are subject to impacts of explosion.

Though injury and death have resulted from oil and gas well drilling and extraction, the majority of impacts from this human-made hazard are environmental in nature. Wells that are improperly drilled or plugged can contaminate groundwater resulting in water well contamination or eventually surface water contamination. Drilling additives stored on site can leak and contaminate soil, surface water, and groundwater. Oil leaks at the well site from oil pipelines contaminate soil and surface water and damage aquatic life and ecosystems.

The impacts of oil and natural gas wells range in magnitude and extent. There are several potential impacts, including those on water, land, and air. Common accidents involving gas well sites include "blowouts," which are an explosion or failure of the rig, as well as the potential for chemical contamination. Beyond the purely environmental impacts of drilling, Centre County is likely to see significant indirect effects on its transportation infrastructure and land cover.

4.3.18.3 Past Occurrence

Pennsylvania has a long history of oil and gas well drilling and, though relatively infrequent, many accidents and incidents have occurred related to the extraction of these natural resources. No comprehensive list of oil and gas related incidents exist for the Commonwealth; however, State Impact reports on violations of active wells. Since January of 2009, there have been 4,006 violations on 7,799 active wells in the Commonwealth with violations ranging from "failure to properly store, transport, process, or dispose of residual waste" to "discharge of pollutional material to waters of Commonwealth." PA DEP issued its 2019 Oil and Gas Annual Report showing that across the Commonwealth, there were 1,783 conventional oil and gas well violations reported as compared to 985 for unconventional wells despite fewer inspections (12,027 versus 18,970 for unconventional wells). The number of violations did decrease from 2018 with 3,017 violations for conventional wells and 1,043 for unconventional. PA DEP also reported a reduction in well permit issuing times by more than 75 percent from 2017 to 2019 (PADEP-OOGM, 2019).

Three oil and gas well drilling incidents were also identified in the Centre County OES incident log. This log has been maintained from January 1989 to present (data for this plan was obtained in January 2021). While this is not a comprehensive source of all incidents in Centre County, it provides an inventory of events that the OES has been involved with. As shown in Table 4.3.18-1, a gas well valve leak and two fires occurred in Centre County. No incidents have occurred since the 2015 Plan Update.

Table 4.3.18-1: Oil and Gas Well Drilling Incidents Recorded in Centre County (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
09/02/89	Fire	Gas Drilling Rig	Curtin Twp
06/02/90	Fire	Gas Well Fire	Snow Shoe Twp
1/28/2012	Gas Well	Gas Well Valve Leak	Bank St, Orviston, Curtin Twp.

4.3.18.4 Future Occurrence

It is difficult to predict when and where environmental hazards will arise as they are often related to equipment failure and human error. Adequate monitoring through PA DEP will reduce the likelihood of potential impacts to the community and to the environment. Risk associated with oil and gas drilling is expected to remain moderate though.

The number of permits issued for oil and gas wells decreases each year, though production continues to increase. Additionally, the number of orphaned and abandoned wells has increased. In PA DEP's 2019 Annual Report, they identified a study in partnership with DCNR in Cornplanter State Forest to measure methane leakage from identified orphan wells. This research will help PA DEP better estimate methane emissions from the thousands of orphaned and abandoned wells in Pennsylvania and determine how to quantify threats from abandoned wells.

Based on the short history of past occurrence, the probability of future conventional oil and gas well event is considered *possible* according to the Risk Factor Methodology (see Section 4.4-1).

4.3.18.5 Vulnerability Assessment

Structures, critical facilities, and populations located near conventional well hazard areas are also at risk. Table 4.3.18-2 shows total number of structures in conventional well hazard areas, which are defined as the area within 1,000 yards of any conventional oil or gas well. Of the total 35 municipalities, 13 have structures located near conventional wells. While Snow Shoe Township contains the highest number of structures located in conventional well hazard areas (925), Burnside Township has the highest percentage of structures located in these areas (92 percent).

Table 4.3.18-2: Structures Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES IN CONVENTIONAL WELL HAZARD AREA	PERCENT STRUCTURES IN CONVENTIONAL WELL HAZARD AREA
Bellefonte Borough	2,658	-	0%
Benner Township	2,369	-	0%
Boggs Township	1,598	230	14%
Burnside Township	441	405	92%
Centre Hall Borough	579	-	0%

Table 4.3.18-2: Structures Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES IN CONVENTIONAL WELL HAZARD AREA	PERCENT STRUCTURES IN CONVENTIONAL WELL HAZARD AREA
College Township	4,810	-	0%
Curtin Township	448	260	58%
Ferguson Township	6,949	-	0%
Gregg Township	1,179	-	0%
Haines Township	1,003	-	0%
Halfmoon Township	1,089	-	0%
Harris Township	2,798	-	0%
Howard Borough	298	-	0%
Howard Township	523	-	0%
Huston Township	684	4	1%
Liberty Township	1,233	73	6%
Marion Township	501	6	1%
Miles Township	944	-	0%
Milesburg Borough	475	-	0%
Millheim Borough	427	-	0%
Patton Township	5,315	-	0%
Penn Township	881	-	0%
Philipsburg Borough	1,309	-	0%
Port Matilda Borough	256	-	0%
Potter Township	2,015	-	0%
Rush Township	2,462	111	5%
Snow Shoe Borough	346	97	28%
Snow Shoe Township	1,347	925	69%
Spring Township	3,654	-	0%
State College Borough	6,861	-	0%
Taylor Township	497	21	4%
Union Township	775	6	1%
Unionville Borough	134	-	0%
Walker Township	2,038	37	2%
Worth Township	471	31	7%
Total	**59,367**	**2,206**	**4%**

Table 4.3.18-3 shows total number of critical facilities in conventional well hazard areas by municipality. A total of six municipalities have critical facilities located near conventional wells: Burnside Township (3), Curtin Township (2), Liberty Township (1), Rush Township (1), Snow Shoe Borough (1), Snow Shoe Township (6). All of Burnside Township's and Curtin Township's critical

facilities are within conventional well hazard areas. These facilities include five dams, one fire station, one medical center, and five water and sewer treatment plants. Dams and water and sewer treatment plants in vulnerable areas maybe susceptible to water contamination during conventional well hazard event.

Table 4.3.18-3: Critical Facilities Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN CONVENTIONAL WELL HAZARD AREA	PERCENT CRITICAL FACILITIES IN CONVENTIONAL WELL HAZARD AREA
Bellefonte Borough	17	-	0%
Benner Township	26	-	0%
Boggs Township	9	-	0%
Burnside Township	3	3	100%
Centre Hall Borough	4	-	0%
College Township	44	-	0%
Curtin Township	2	2	100%
Ferguson Township	27	-	0%
Gregg Township	10	-	0%
Haines Township	7	-	0%
Halfmoon Township	5	-	0%
Harris Township	8	-	0%
Howard Borough	4	-	0%
Howard Township	1	-	0%
Huston Township	1	-	0%
Liberty Township	5	1	20%
Marion Township	3	-	0%
Miles Township	15	-	0%
Milesburg Borough	3	-	0%
Millheim Borough	4	-	0%
Patton Township	22	-	0%
Penn Township	15	-	0%
Philipsburg Borough	9	-	0%
Port Matilda Borough	4	-	0%
Potter Township	15	-	0%
Rush Township	26	1	4%
Snow Shoe Borough	2	1	50%
Snow Shoe Township	8	6	75%
Spring Township	19	-	0%
State College Borough	36	-	0%

Table 4.3.18-3: Critical Facilities Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN CONVENTIONAL WELL HAZARD AREA	PERCENT CRITICAL FACILITIES IN CONVENTIONAL WELL HAZARD AREA
Taylor Township	1	-	0%
Union Township	5	-	0%
Unionville Borough	-	-	0%
Walker Township	13	-	0%
Worth Township	2	-	0%
Total	375	14	4%

Table 4.3.18-4 shows the vulnerability of the County's population to conventional well hazard areas. One percent of the County's population lives in conventional well hazard areas. Thirteen municipalities have populations living within these areas. While Gregg Township has the most people (498) living within conventional well hazard areas, Milesburg Borough has the highest percentage of population (42 percent).

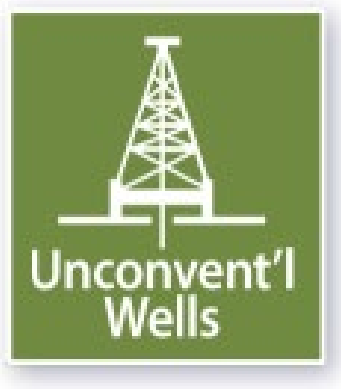
Table 4.3.18-4: Population Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL ESTIMATED 2010 POPULATION	TOTAL POPULATION IN CONVENTIONAL WELL HAZARD AREA	PERCENT POPULATION IN CONVENTIONAL WELL HAZARD AREA
Bellefonte Borough	7,457	-	0%
Benner Township	1,928	-	0%
Boggs Township	1,951	-	0%
Burnside Township	864	182	21%
Centre Hall Borough	573	-	0%
College Township	8,126	-	0%
Curtin Township	1,227	-	0%
Ferguson Township	2,482	-	0%
Gregg Township	2,220	498	22%
Haines Township	1,137	239	21%
Halfmoon Township	2,608	93	4%
Harris Township	24,486	-	0%
Howard Borough	46,258	-	0%
Howard Township	1,853	-	0%
Huston Township	20,404	-	0%
Liberty Township	11,607	-	0%
Marion Township	907	-	0%
Miles Township	4,539	379	8%

Table 4.3.18-4: Population Vulnerable to Conventional Oil and Gas Wells

MUNICIAPLITY	TOTAL ESTIMATED 2010 POPULATION	TOTAL POPULATION IN CONVENTIONAL WELL HAZARD AREA	PERCENT POPULATION IN CONVENTIONAL WELL HAZARD AREA
Milesburg Borough	501	208	42%
Millheim Borough	1,953	-	0%
Patton Township	2,356	2	0%
Penn Township	2,558	-	0%
Philipsburg Borough	2,095	-	0%
Port Matilda Borough	1,128	83	7%
Potter Township	1,640	278	17%
Rush Township	3,911	-	0%
Snow Shoe Borough	1,177	213	18%
Snow Shoe Township	2,415	24	1%
Spring Township	4,954	-	0%
State College Borough	3,433	-	0%
Taylor Township	19,028	-	0%
Union Township	3,691	-	0%
Unionville Borough	5,525	24	0%
Walker Township	5,029	314	6%
Worth Township	5,598	-	0%
Total	207,619	2,537	1%

4.3.19 Environmental Hazards – Unconventional Oil and Gas Wells



4.3.19.1 Location and Extent

PA DEP defines unconventional wells as wells drilled deep into shale rock formations found thousands of feet underground. These formations, mainly Marcellus Shale and Utica Shale, contain and produce natural gas. These wells use horizontal drilling techniques that use large quantities of high-pressured water, approximately one to eight million gallons, mixed with sand and other additives including hydrochloric and muriatic acid, to hydraulically fracture the rock. This practice is more commonly known as fracking. This type of extraction presents unique challenges for the County.

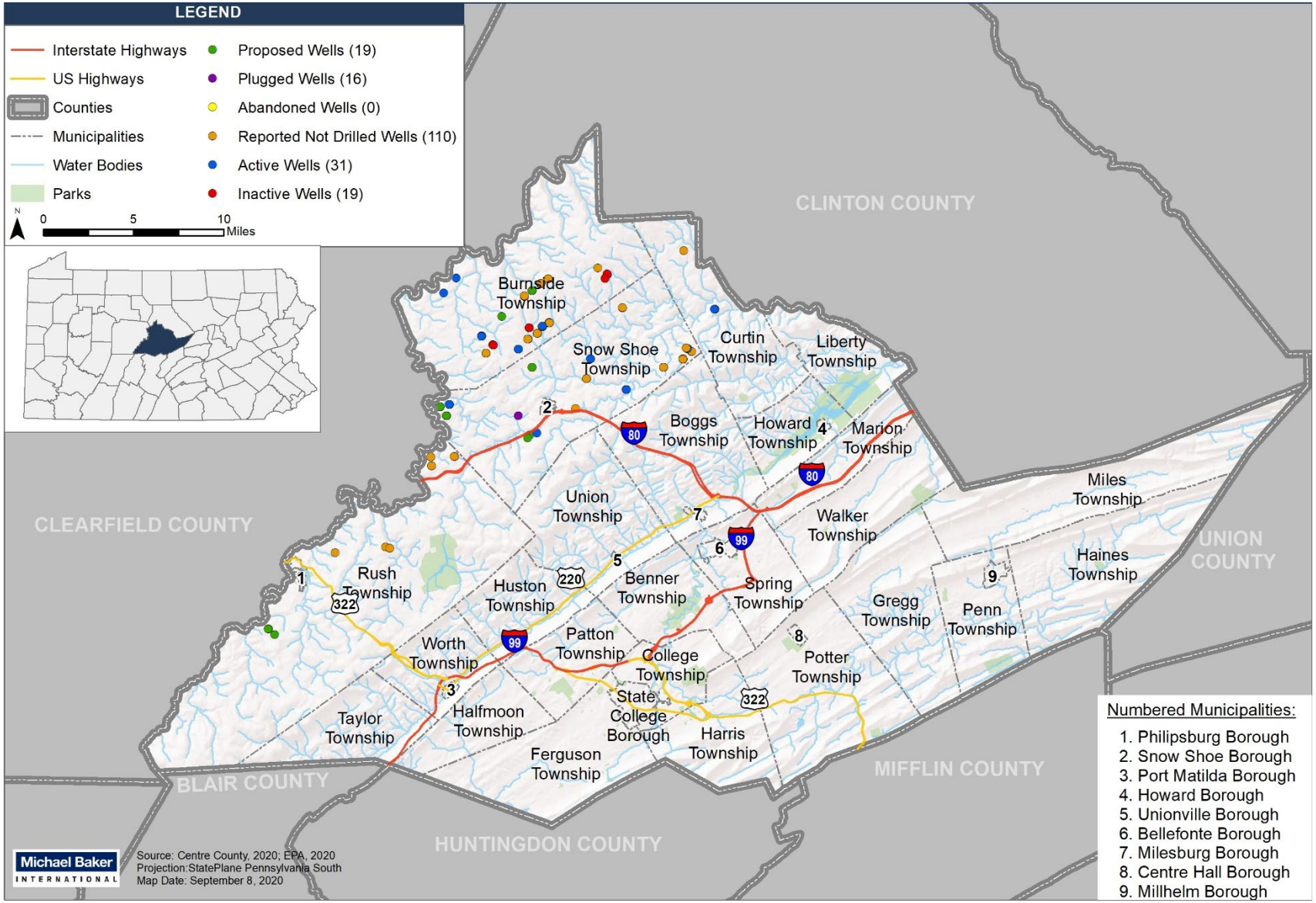
There are 31 active and 19 inactive unconventional wells. There are 19 wells with a status of "proposed, but never materialized," meaning that a permit application was submitted but not approved, a well was entered erroneously into the database, or the permit was issued but the well was never drilled. There are also 16 plugged wells and 110 wells with a status of "operator reported not drilled," meaning the well permit has expired without being drilled or that the operator will not seek to drill. As shown in Figures 4.3.19-1 and similar to conventional wells, unconventional wells are also concentrated in the northern part of the County, primarily in Burnside, Snow Shoe, and Curtin Townships.

4.3.19.2 Range of Magnitude

There are some similarities in Range of Magnitude for both unconventional wells and conventional wells, though unconventional gas mining presents its own set of hazards as well.

The Marcellus Shale formation exists at a depth normally between 5,000 and 8,000 feet and holds trillions of cubic feet of natural gas. Extraction from this depth was previously not feasible but as drilling technology has improved over the years, recovering natural gas from Marcellus Shale is now possible (PADEP-OOGM, 2010). This extraction process is different from traditional natural gas extraction in that it often requires horizontal drilling. Horizontal drilling is accomplished by hydraulic fracturing, which involves pumping one to eight million gallons of water, mixed with sand and other additives including hydrochloric or muriatic acid, into the shale formation. The fluid or "frac fluid" that is recovered from this process must be properly treated as the water quality is very poor.

Figure 4.3.19-1: Unconventional Oil and Gas Well Locations in Centre County



This extraction process is different from traditional natural gas extraction in that it often requires horizontal drilling. Horizontal drilling is accomplished by hydraulic fracturing which involves pumping one to eight million gallons of water, mixed with sand and other additives including hydrochloric or muriatic acid, into the shale formation. The fluid or "frac fluid" that is recovered from this process must be properly treated as the water quality is very poor.

Frac fluid is extremely saline and can be three to six times as salty as sea water. Other contaminants can include barium, bromine, lithium strontium, sulfate, ammonium, and very high concentrations of total dissolved solids (TDS). There is also some concern about normally occurring radioactive materials (NORMS) present in shale and potentially present in recovered drilling fluid, but there is very little data available on the radioactivity of frac fluid in Pennsylvania (Kirby, 2010).

Currently there is no known technology to treat water with this level of salinity (Vidic, 2010). High levels of total dissolved solids (TDSs), though not harmful to humans, can be extremely harmful to aquatic life and can damage industrial equipment. Often, recovered frac fluid is stored in earthen impoundments and after treatment is taken to a sewage treatment facility. There is concern surrounding the toxic solid waste that remains after frac fluid is treated.

In addition to the traditional hazards associated with oil and gas well drilling, potential impacts from Marcellus Shale gas well drilling include:

- Surface water depletion from high consumptive use with low return rates affecting drinking water supplies, and aquatic ecosystems and organisms.
- Contaminated surface and groundwater resulting from hydraulic fracturing and the recovery of contaminated hydraulic fracturing fluid.
- Mishandling of solid toxic waste.
- Public health concerns.

The water used for hydraulic fracturing is composed of 87 chemicals, some of which have the potential to cause a danger to health of life (PADEP-OOGM, 2010). Beyond the purely environmental impacts of drilling, Centre County is likely to be see significant indirect effects on its transportation infrastructure and land cover.

The worst-case scenario for an oil or gas well incident would be if there was a discharge of pollutant material like frac fluid into the waterways of Centre County. This is particularly and issue in the southern and central portions of the county, where there are a higher number of reported domestic water wells and potentially, a greater amount of reliance on these wells for potable water supply.

DOH has indicated some level of concern regarding unconventional drilling. Both unconventional and conventional wells are often located near residential areas, and there are growing concerns among the public, media and researchers about environmental contamination of water, air and soil from drilling and associated operations (e.g., pipelines, compressor stations, wastewater storage). These concerns have raised numerous questions

about adverse health impacts associated with unconventional drilling. In March 2017, PA DOH developed a confidential health registry to better track and respond to public health complaints related to these types of wells. 132 total health complaints have been logged by PA DOH since 2011 across the Commonwealth (PA DOH, 2020c).

4.3.19.3 Past Occurrence

Pennsylvania has a long history of oil and gas well drilling and, though relatively infrequent, accidents and incidents have occurred related to the extraction of these natural resources. No comprehensive list of oil and gas related incidents exist for the Commonwealth; however, major gas and oil well incidents in Pennsylvania are captured in PEMA's incident management system, PEMA-KC. While access to this data is restricted, the PA HMP reported in 2018 that no gas and oil incidents were recorded between 2013 and 2018.

4.3.19.4 Future Occurrence

As is the case with conventional wells, it remains difficult to predict the number or frequency of unconventional well site incidents. It is difficult to predict when and where environmental hazards will arise as they are often related to equipment failure and human error. Adequate monitoring through the PA DEP will reduce the likelihood of potential impacts to the community and to the environment.

Overall, the probability of a future unconventional oil and gas well event is *possible* as defined by the Risk Factor Methodology (see Section 4.4-1).

4.3.19.5 Vulnerability Assessment

Structures, critical facilities, and populations located near unconventional well hazard areas are also at risk, which are defined as areas within 1,000 yards of any unconventional oil or gas well. Table 4.3.19-1 shows total number of structures in unconventional well hazard areas by municipality. Four municipalities have structures located near unconventional wells including Burnside, Curtin, Rush, and Snow Shoe Townships. Snow Shoe Township has the highest number of structures within the unconventional well hazard area (132). An analysis was also done to determine if any critical facilities were located in unconventional oil and gas well hazard areas. It was determined that there are no municipalities with critical facilities located near unconventional wells.

Table 4.3.19-1: Structures Vulnerable to Unconventional Oil and Gas Wells

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN UNCONVENTI-ONAL WELL HAZARD AREA	PERCENT STRUCTURES IN UNCONVENTIONAL WELL HAZARD AREA
Bellefonte Borough	2,658	-	0%
Benner Township	2,369	-	0%
Boggs Township	1,598	-	0%
Burnside Township	441	65	15%
Centre Hall Borough	579	-	0%
College Township	4,810	-	0%

Table 4.3.19-1: Structures Vulnerable to Unconventional Oil and Gas Wells

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN UNCONVENTI-ONAL WELL HAZARD AREA	PERCENT STRUCTURES IN UNCONVENTIONAL WELL HAZARD AREA
Curtin Township	448	7	2%
Ferguson Township	6,949	-	0%
Gregg Township	1,179	-	0%
Haines Township	1,003	-	0%
Halfmoon Township	1,089	-	0%
Harris Township	2,798	-	0%
Howard Borough	298	-	0%
Howard Township	523	-	0%
Huston Township	684	-	0%
Liberty Township	1,233	-	0%
Marion Township	501	-	0%
Miles Township	944	-	0%
Milesburg Borough	475	-	0%
Millheim Borough	427	-	0%
Patton Township	5,315	-	0%
Penn Township	881	-	0%
Philipsburg Borough	1,309	-	0%
Port Matilda Borough	256	-	0%
Potter Township	2,015	-	0%
Rush Township	2,462	35	1%
Snow Shoe Borough	346	-	0%
Snow Shoe Township	1,347	132	10%
Spring Township	3,654	-	0%
State College Borough	6,861	-	0%
Taylor Township	497	-	0%
Union Township	775	-	0%
Unionville Borough	134	-	0%
Walker Township	2,038	-	0%
Worth Township	471	-	0%
Total	59,367	239	0%

Table 4.3.19-2 shows the vulnerability of the County's population to unconventional well hazard areas. Less than one percent of the County's population lives in unconventional well hazard areas. Only three municipalities have populations living within these areas: Gregg Township (56 persons), Milesburg Borough (17), and Walker Township (287); six percent of Walker Township is within the unconventional well hazard area.

Table 4.3.19-2: Population Vulnerable to Unconventional Oil and Gas Wells

MUNICIAPLITY	TOTAL ESTIMATED 2010 POPULATION	TOTAL POPULATION IN UNCONVENTIONAL WELL HAZARD AREA	PERCENT POPULATION IN UNCONVENTIONAL WELL HAZARD AREA
Bellefonte Borough	7,457	-	0%
Benner Township	1,928	-	0%
Boggs Township	1,951	-	0%
Burnside Township	864	17	2%
Centre Hall Borough	573	-	0%
College Township	8,126	-	0%
Curtin Township	1,227	-	0%
Ferguson Township	2,482	-	0%
Gregg Township	2,220	-	0%
Haines Township	1,137	-	0%
Halfmoon Township	2,608	-	0%
Harris Township	24,486	-	0%
Howard Borough	46,258	-	0%
Howard Township	1,853	-	0%
Huston Township	20,404	-	0%
Liberty Township	11,607	-	0%
Marion Township	907	-	0%
Miles Township	4,539	-	0%
Milesburg Borough	501	-	0%
Millheim Borough	1,953	-	0%
Patton Township	2,356	-	0%
Penn Township	2,558	-	0%
Philipsburg Borough	2,095	-	0%
Port Matilda Borough	1,128	-	0%
Potter Township	1,640	-	0%
Rush Township	3,911	287	7%
Snow Shoe Borough	1,177	-	0%
Snow Shoe Township	2,415	56	2%
Spring Township	4,954	-	0%
State College Borough	3,433	-	0%
Taylor Township	19,028	-	0%
Union Township	3,691	-	0%
Unionville Borough	5,525	-	0%
Walker Township	5,029	-	0%
Worth Township	5,598	-	0%
Total	207,619	360	0%

4.3.20 Nuclear Incidents

4.3.20.1 Location and Extent

Through a Memorandum of Understanding (MOU), the Nuclear Regulatory Commission (NRC) and FEMA share federal oversight for nuclear/radiological emergency response planning matters for licensed nuclear power plants. Their mutual efforts will be directed toward more effective plans and related preparedness measures at and in the vicinity of nuclear reactors and fuel cycle facilities. The MOU between the agencies was signed on January 14, 1980, in response to the president's decision of December 7, 1979, stating that FEMA will coordinate all federal planning for the off-site impact of nuclear/radiological emergencies; take the lead for assessing off-site nuclear/radiological emergency response plans and preparedness; make findings and determinations as to the adequacy and capability of implementing off-site plans; and communicate those findings and determinations to the NRC. The NRC reviews those FEMA findings and determinations, in conjunction with the NRC's on-site findings, to determine the overall state of emergency preparedness (Penn State, 2020c).

A separate MOU, dated October 22, 1980, deals with NRC and FEMA cooperation and responsibilities in response to an actual or potential nuclear/radiological emergency. Operations Response Procedures have been developed that implement the provisions of the Incident Response MOU. These documents are intended to be consistent with the Federal Radiological Emergency Response Plan, which describes the relationships, roles, and responsibilities of federal agencies for responding to accidents involving peacetime nuclear/radiological emergencies (Penn State, 2020c).

Centre County has one fixed nuclear facility located at Penn State University. The Penn State Breazeale Nuclear Reactor (PSBR) is the longest operating licensed research reactor in the United States. The reactor, designated R-2, is the result of the "Atoms for Peace" program started by President Dwight Eisenhower. At the time, the President of the University was Milton Eisenhower (the brother of the U.S. President). In 1953, the Penn State Board of Trustees authorized money for the reactor's construction, and the PSBR went live in 1955 (Penn State, 2020c).

The PSBR Laboratory Complex is also known as the Radiation Science and Engineering Center. In addition to the TRIGA Mark III Reactor, it also contains the Cobalt-60 Radiation Facility, two hot cells, the Radiochemistry Laboratories, and supporting radiation sources, radiation detectors, and counting equipment (Penn State, 2020c).

The NRC encourages the use of Probabilistic Risk Assessments (PRAs) to estimate quantitatively the potential risk to public health and safety when considering the design, operations, and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. FEMA, PEMA, and county governments have formulated Radiological Emergency Response Plans (RERPs) to prepare for nuclear/radiological emergencies at the five nuclear power-generating facilities in the Commonwealth of Pennsylvania. These plans include the following:

- A Plume Exposure Pathway EPZ within a radius of 10 miles from each power plant
- An Ingestion Exposure Pathway EPZ within a radius of 50 miles from each plant

Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from the plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation. The exact size and configuration of the EPZ may vary in relation to local emergency response capabilities, topography, road networks, and political boundaries.

The County RERPs, which are part of the County Emergency Operations Plan, also include the following:

- Preventive and emergency protective actions
- Response levels and associated protective action guides (PAGs) for food
- Recommended PAGs within an Ingestion Exposure Pathway EPZ
- Information for farmers to assist in protection of their livestock and crops from radioactive contamination

Nuclear facilities must notify the appropriate authorities in the event of an accident. The federally recognized classification levels are Unusual Event, Alert, Site Area Emergency, and General Emergency. After a nuclear/radiological incident, the main concern is the effect on the health of the population near the incident. External radiation, inhalation, and ingestion of radioactive isotopes can cause acute health effects (death, severe health impairment), chronic health effects (cancers), and psychological effects that can affect health. Additional considerations include the long-term effects to the environment and agriculture.

At the time of this update, PEMA is in the process of updating their Nuclear Evacuation plan in order to effectively target response to a nuclear incident. Through this method, the Commonwealth will transition from an "all go/no go" approach to evacuation or shelter to a keyhole approach where only sub areas that are directly impacted by a nuclear incident would

have to evacuate or shelter. This new method will allow for focused resources and attempt to minimize unnecessary strain on emergency services. While this plan is still being developed, it will impact how and when Centre County will respond to a nuclear incident.

4.3.20.2 Range of Magnitude

The PSBR is a one-Megawatt Mark III TRIGA Reactor (Penn State, 2020c). The reactor is licensed pursuant to Title 10 Code of Federal Regulations, Chapter 1, Part 50, as a research and utilization reactor, Facility Operating License No. R-2 (Docket No. 50-5). The SBR does not provide electricity to the Penn State campus, rather it is used explicitly for education and research. This is also because the output of the reactor is only one thermal Megawatt and licensed to only operate at that level by the NRC. For a comparison, Three Mile Island has a net generating capacity of 852 Megawatts.

Susquehanna Steam Electric Station is the closest nuclear power plant, approximately 100 miles away from Centre County; all other nuclear power plants in the state are over 110 miles away. Centre County lies just on the edge of the Susquehanna Steam Electric Station 50-mile Ingestion Exposure Pathway EPZ designated for nuclear/radiological emergencies. The magnitude of a nuclear incident differs for those within the Plume Exposure Pathway EPZ and those within the Ingestion Exposure Pathway EPZ. The Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation.

Nuclear accidents themselves are classified 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.

Nuclear facilities must notify the appropriate authorities in the event of an accident. The 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 (PAGs).

- 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 PAGs 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 PAGs for more than the immediate site area.

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 the Commonwealth and the nation. 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.

The worst-case radiological release event would be a major release of radioactive material from the PSBR. This event could generate a great deal of fear for residents of Centre County and central Pennsylvania. Specific impacts would depend on the extent and spread of the contamination, although it would likely affect the Penn State University campus. However, as previously mentioned, the PSBR is much smaller than power-generating reactors.

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, which includes a number of sirens to alert the public located in the Plume Ingestion Pathway EPZ. This alerting system is activated by the counties of each specific EPZ. Emergency notifications and instructions are communicated to the public via the Emergency Alert System as activated by the SEOC. State officials also have the capability to send emergency messages as text messages to mobile devices.

4.3.20.3 Past Occurrence

Since the PSBR was built in 1955, there have been no accidents or evacuations involving a degradation or problem with the reactor. The reactor control system is designed to shut down the reactor automatically if any preset limits are reached. These limits are set well below the established safety parameters. In 2007, a minor leak of "slightly radioactive water" was reported. Authorities discovered the leak during a routine check of the pool water levels that naturally decrease with evaporation.

It was not considered a health risk due to the low radiation levels. It was reported that radiation levels were just above the drinking water standard and dissipation would further reduce any measurable radiation levels by the time any water leakage would have reached a water table. The reactor holds 71,000 gallons of water. The reactor was shut down, workers drained the pool and resurfaced its walls, which seemed to stop the leak, although no specific cause of the water loss was identified.

Nuclear incidents rarely occur, but the incident at Three Mile Island is the worst fixed-nuclear facility accident in U.S. history. The resulting contamination and state of the reactor core led to the development of a 14-year cleanup and scientific effort. Additionally, the President's Commission on the Accident at Three Mile Island examined the costs of the accident, concluding, "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."

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 PA DOH's Three Mile Island Health Research Program did find evidence of psychological stress (Nuclear Energy Institute, 2019).

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.

4.3.20.4 Future Occurrence

In late 2009, the NRC extended the operating license of the facility for two additional decades (Penn State, 2020c). Penn State University was commended for good safety measures and reviews of aspects such as the structural integrity of the building and its defense against radiation were satisfactory. It should be noted, however, that following the September 11, 2001 attacks, the NRC deemed it "at risk," despite its small size, as a potential terrorist target. Penn State University maintains an in-house capability to control most hazards which may occur in this facility. They also maintain mutual aid agreements with other agencies designated in their emergency plan.

Overall, the probability of future nuclear incident events is *unlikely* as defined by the Risk Factor Methodology (See Section 4.4-1).

4.3.20.5 Vulnerability Assessment

The Director of the Radiation Science and Engineering Center is ultimately responsible for safe operation of the facility, assisted by a staff dedicated to the safe conduct of facility operations. The Director and staff operate under several licenses issued by the NRC for operation of the nuclear reactor and associated facilities, and for the control of radioactive materials. A Penn State Reactor Safeguards Committee (PSRSC), consisting of university and industry representatives, meets quarterly to review facility operations. The PSRSC also appoints an auditor to perform an annual audit of facility operations for compliance to

NRC and Penn State regulations.

According to the NRC's report on the reactor during the recent (2009) renewal of its operating license, the facility poses "no significant radiological risk to the health and safety of the public, facility personnel, or the environment." The report also concluded the reactor has adequate funding and qualified personnel to continue operation for the next 20 years. Furthermore, evacuation drills are also conducted on an annual basis to assess response capabilities.

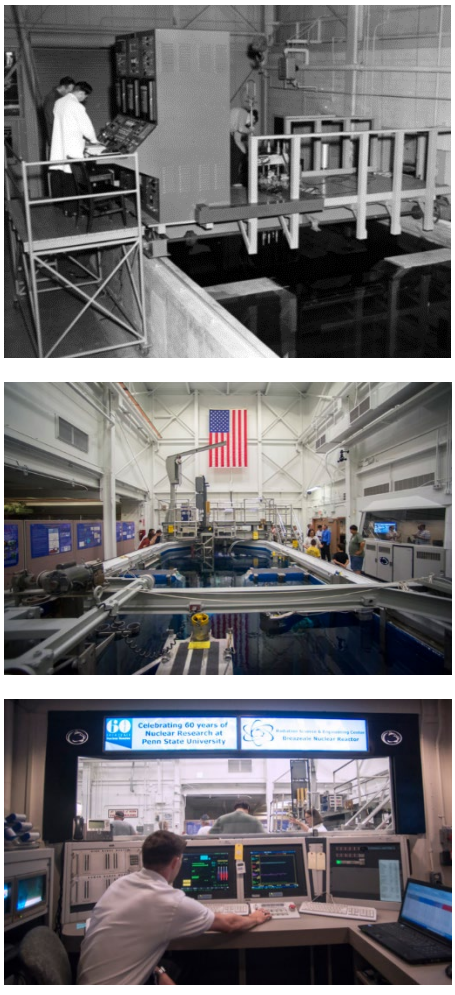


Figure 4.3.20-1: Penn State Breazeale Nuclear Reactor (Penn State News, 2020)

4.3.21 Opioid Addiction

4.3.21.1 Location and Extent

Opioid addiction occurs when an individual becomes physically dependent on opioid, a class of drugs that reduces pain. Opioid is used as a broad term and includes opiates, which are drugs naturally extracted from certain types of poppy plants and narcotics. Opioids can also be synthetically made to emulate opium.

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

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

Opioids are highly addictive. They block the body's ability to feel pain and can create a sense of euphoria. Additionally, individuals often build a tolerance to opioids, which can lead to misuse and overdose. Fentanyl and fentanyl-related substances are hazardous materials and should be treated as such. Contact with fentanyl can impact first responders and family and friends of opioid users. Depending on the potency of the drug, it can take as a little as the equivalent of a few grams of table salt to cause health complications (DEA, 2020).

Opioid addiction impacts the entire Commonwealth. Nationally, Pennsylvania is among four of the hardest hit states from opioid-related deaths, along with West Virginia, Ohio, and New Hampshire.

The CDC estimates that nearly 38 out of every 100,000 Pennsylvania residents died from opioid-related overdoses in 2016, higher than the national rate of opioid-related deaths of approximately 20 out of 100,000 people.

In Pennsylvania, overdoses caused by opioids have become the leading cause of accidental death, surpassing automobile accidents (CDC, 2018).

People under the age of 35 have been particularly vulnerable to the opioid virus. According to a joint intelligence report prepared by the DEA Philadelphia Division and the University of Pittsburgh, between 2015 and 2016 in Pennsylvania, fentanyl use increased 380 percent among 15- to 24-year-olds while heroin use increased 970 percent in the 25- to 34-year age range. The report also documented a higher percentage of drug-related deaths attributed to opioid use in Pennsylvania's rural communities at 42 percent, compared to 34 percent in urban communities (DEA Philadelphia Division, 2017).

According to a recent study, environmental scientists at the Cary Institute of New York found traces of opioid and other drugs in streams, rivers, and lakes. These traces came from human urine and feces, and medications that have been flushed down the toilet. However, the ecological and environmental impacts are unknown. The EPA suggests that while the risks of pharmaceuticals found in wastewater, ambient water, and drinking water is low, further research is needed (US EPA, 2014a).

4.3.21.2 Range of Magnitude

Opioid addiction can lead to overdose, which can be fatal. The most dangerous side effect of an opioid overdose is depressed breathing. The lack of oxygen to the brain causes permanent brain damage, leading to organ failure, and eventually, death. Signs and symptoms include respiratory depression, drowsiness, disorientation, pinpoint pupils, and clammy skin.

Opioid addiction can also be passed from mother to child in the womb. This condition, known as neonatal abstinence syndrome, has increased five-fold from 2000 to 2012, according to the National Institute of Drug Abuse (NIDA), resulting in an estimated 22,000 babies in the United States born with this condition (NIDA, 2019).

First responders – paramedics, police officers, and fire fighters, are also affected by Pennsylvania's opioid addiction crisis. In addition to the crisis consuming time and resources, first responders also face exposure risk, particularly to synthetic fentanyl. According to the DEA, it takes two to three milligrams of fentanyl to induce respiratory depression, arrest, and possibly death. Since fentanyl is indistinguishable from several other narcotics and powdered substances, first responders must take extra precaution when dealing with calls related to drug abuse (Rushton, 2019).

In 2018, Centre County experienced three opioid-related deaths in six days. Local Law enforcement and the Centre County District Attorney's Office warned citizens about a possible rise in the sale of lethal illegal narcotics in the area (Rushton, 2019).

4.3.21.3 Past Occurrence

The CDC found that opioids are the main cause of drug-related overdoses and deaths, being responsible for nearly 75 percent of drug-related deaths nationally in 2017. Of the more than 4,600 drug-related deaths in Pennsylvania in 2016, nearly 84 percent were attributed to two or more drugs. Therefore, drug-related overdose and death statistics account for all drug types, however, as noted above, the majority of drug-related deaths involve opioids. Opioid-related deaths in Centre County are tracked by the Coroner's office. Overdose Free PA collects county

information across the state to track trends in opioid related issues. The following table lists opioid-related deaths from 2015-2020:

Table 4.3.21-1: Number of Opioid-Related Deaths in Centre County from 2015-2020 (OverdoseFreePA, 2020)

YEAR	NUMBER OF DEATHS
2015	15
2016	21
2017	14
2018	22
2019	9
2020	17*

*Figure reported by Centre County OES on January 7, 2020

Though an opioid addiction crisis is complex and unprecedented, it is widely acknowledged that the opioid crisis began in the late 1990s when pharmaceutical companies introduced opioid-based pain medication, such as OxyContin, Percocet, and Vicodin. As these drugs become more frequently prescribed, misuse and overdose increased and it became clear that prescription opioids were highly addictive (NIDA, 2020).

4.3.21.4 Future Occurrence

Pennsylvania has seen a steady rise in opioid-related deaths over the last several years, with drug-related death rates increasing 102 percent between 2014 and 2017. If opioid-related deaths continue to increase at this pace, then the Commonwealth could experience an estimated 10,000 drug-related deaths in the year 2020.

However, future occurrences of opioid addiction and misuse, overdose, and fatalities are unclear as the state moves forward with overdose prevention initiatives. In January 2018, Governor Tom Wolf declared Pennsylvania's opioid addictions epidemic a disaster emergency. This declaration should enhance coordination and data collection between state and local responders, improve tools for families and first responders, and expand treatment access. The declaration also improves access to naloxone, a lifesaving drug that reverses the effects of a drug-overdose. In addition, a new Opioid Coordination Group is housed within PEMA (PA DOH, 2018).

In May 2016, a Memorandum of Understanding was executed, formally creating the Centre County Heroin and Opioid Prevention and Education (HOPE) Initiative (Centre County, 2020c). Members of the HOPE Initiative include those from the prevention, treatment, and recovery community; agencies involved in the Criminal Justice System, and members of the community affected by addiction. HOPE conducts widespread outreach and education in order to educate all community members about drug addiction with the goal of preventing overdoses and overdose deaths. HOPE also works to increase access to drug collection boxes, naloxone, and medication assisted therapies.

Overall, the probability of future opioid overdose and death is *highly likely* as defined by the Risk Factor Methodology (see Section 4.4.1).

4.3.21.5 Vulnerability Assessment

County facilities are not at risk to the opioid crisis, but there are some occupation-specific risks that may make some employees more vulnerable. Employees working in direct patient care are vulnerable to fentanyl exposure. Since fentanyl can be ingested orally, inhaled through the nose or mouth, or absorbed through the skin or eyes, any substance suspected to contain fentanyl should be handled with extreme caution. Exposure to a small amount of fentanyl can lead to respiratory depression or death. Fentanyl-related substances have been found in powders, pills, capsules, liquids, and on blotter paper. The DEA recommends that all first responders carry a Personal Protective Equipment (PPE) kit that includes: nitrile gloves, N-95 dust masks, sturdy eye protection, paper coveralls and show protection, and naloxone injectors. The DEA also suggests using extreme caution when using police dogs, as they are at serious risks to health complications from inhaling fentanyl and fentanyl-related substances (DEA, 2016).

Additionally, absenteeism from jobs associated with an opioid addiction in high-risk areas could lead to economic loss through lost productivity and increased medical costs.

In general, jurisdictions that are more densely populated are more vulnerable to opioid addiction threats as access to the drugs increases. However, as stated above, rural communities have experienced larger per-capita opioid-related deaths.

Jurisdictional losses in the opioid addiction crisis stem from lost wages, productivity, and resources rather than losses to buildings or land. Locally, many Pennsylvania counties have seen an increase of time and resources devoted to the opioid epidemic as overdose and response increases, however there is no comprehensive tracking mechanism to record total local losses associated with the opioid crisis.

Impacts including total costs to jurisdictions are only beginning to be understood, researched, and tracked. There is no comprehensive database currently tracking monetary losses at the local level. However, the American Enterprise Institute (AEI), using national data from the CDC and White House Council of Economic Advisors, calculated a total cost per capita ($1,799), of the opioid epidemic for Pennsylvania. Using this per capita estimate in combination with county population estimates, losses can be estimated for Centre County. It is important to note that this methodology assumes equal per capita opioid misuse and fatalities across all counties, however, based on reported drug overdoses and drug related deaths, it is known that some counties, including those in the southwestern region, are more vulnerable and more likely to experience higher per capita costs while counties in central and north central Pennsylvania tent to be less vulnerable and likely have lesser costs per capita. Another important caveat regarding this methodology is that a portion of the costs will have been state losses rather than County or jurisdictional, but the ratio of state to local cost burden is unknown at this time. It is estimated that Centre County has had a total per capita cost of $292,625,340.

4.3.22 Terrorism

4.3.22.1 Location and Extent

The term "terrorism" refers to intentional, criminal, malicious acts, but the functional definition of terrorism can be interpreted in many ways. Officially, terrorism is defined in the Code of Federal Regulations as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 CFR §0.85).

The Federal Bureau of Investigation (FBI) characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. However, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and its consequences.

Terrorism refers to the use of weapons of mass destruction (WMD), including, biological, chemical, radiological, and nuclear weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and agriterrorism; intentional hazardous materials releases; and cyberterrorism.

Terrorism is a threat everywhere, but there are a number of important considerations in evaluating terrorism hazards, such as the existence of facilities, landmarks, or other buildings of international, national, or regional importance. High-risk targets for acts of terrorism include military and civilian government facilities, international airports, large cities, and high-profile landmarks. Terrorists might also target large public gatherings, water and food supplies, utilities, and corporate centers. Furthermore, terrorists are capable of spreading fear by sending explosives or chemical and biological agents through the mail (FEMA, 2009). Additionally, terrorists use threats to create fear, to try to convince citizens of the powerlessness of their government, and/or to get publicity for their cause. Nonetheless, terrorism can take many forms and terrorists have a wide range of personal, political, or cultural agendas.

The probability of terrorism cannot be quantified with as great a level of accuracy as that of many natural hazards. Furthermore, these incidents generally occur at a specific location, such as a government building, rather than encompassing an area such as a floodplain.

An important consideration in evaluating terrorism hazards is the existence of facilities, landmarks, or other buildings of international, national, or regional importance. Outside of Penn State University and the threat of an incident during a major event such as a football game or the Arts Festival, in the remainder of Centre County, while possessing many notable landmarks from a local historic perspective, there are no sites that are considered significant landmarks in terms of national or international importance.

Nonetheless, terrorism can take many forms and terrorists have a wide range of personal, political, or cultural agendas. Therefore, there is no location that is not a potential terrorist target. Two types of terrorist activity are particularly relevant to Centre County: agriterrorism and intentional hazardous material releases. Agriterrorism is the direct, intentional, generally covert contamination of food supplies or introduction of pests and/or disease agents to crops and livestock. Centre County is semi-rural with a significant portion of its land area in the eastern county dedicated to agriculture.

There are also a number of SARA Title III facilities and major transportation routes that traverse the County; making intentional hazardous material releases a potential threat to citizens and the environment. This hazard is addressed in Section 4.3.17. Critical facilities including police stations, hospitals, fire stations, schools, wastewater treatment plants, water supply facilities, may be potential terrorist targets.

4.3.22.2 Range of Magnitude

Terrorist attacks can take many forms, including agriterrorism, arson/incendiary attack, armed attack, biological agent, chemical agent, cyberterrorism, conventional bomb, intentional hazardous material release, nuclear bomb, and radiological agent. The severity of terrorist incidents depends upon the method of attack, the proximity of the attack to people, animals, or other assets and the duration of exposure to the incident or attack device. For example, chemical agents are poisonous gases, liquids, or solids that have toxic effects on people, animals, or plants. Many chemical agents can cause serious injuries or death. In this case, severity of injuries depends on the type and amount of the chemical agent used and the duration of exposure.

Biological agents are organisms or toxins that have illness-producing effects on people, livestock, and crops. Some biological agents cannot be easily detected and may take time to develop. Therefore, it can be difficult to know that a biological attack has occurred until victims display symptoms. In other cases, the effects are immediate. Those affected by a biological agent require the immediate attention of professional medical personnel. Some agents are contagious which may result in the need for victims to be quarantined.

An evolving type of terrorist threat is Complex Coordinated Terrorist Attacks (CCTAs). CCTAs are acts of terrorism that involve synchronized and independent team(s) at multiple locations, sequentially or in close succession, initiated with little or no warning, and employing one or more weapon systems which could include firearms, explosives, fire as a weapon, and other nontraditional attack methodologies that are intended to result in large numbers of casualties

(FEMA, 2018b). The dynamic of CCTAs cause the threat to be unknown, which is a shift from the traditional symbolic and highly planned attacks. CCTAs could occur anywhere, at any time, with the potential for mass casualties and infrastructure damage.

Depending on the type of terrorist attack, there may be significant loss of life for humans and animals as well as economic losses. Additionally, the impact of the attack itself may be exacerbated by the fact that human services agencies like community support programs, health and medical services, public assistance programs, and social services can experience physical damage to facilities, supplies, and equipment and disruption of emergency communications. There may also be ancillary effects of terrorism such as urban fires or, in the case of a radiological device, radioactive fallout that can multiply the impact of a terrorist event.

A worst-case scenario event for Centre County would involve an active shooter incident or the use of explosive devices with radiological material at a public event at Penn State University, such as a football game. This type of event would cause casualties and fatalities across all demographics, and depending on the time of recovery, would cause severe economic losses. In addition to the physical injuries, there will be high emotional and behavioral impacts on the population who was near the attack, as well as the residents of Centre County who were not near the attack.

4.3.22.3 Past Occurrence

There has been a high consciousness of terrorist activity in the press with few catastrophic events. The most significant terrorist attack on United States soil occurred on September 11, 2001; Flight 93, the fourth hijacked aircraft in the attack, crashed in Somerset County, Pennsylvania.

While there have not been any catastrophic terrorist attacks in Centre County, the County has experienced suspected terrorist incidents in the past. Centre County OES maintains an incident log, which contains 82 events related to terrorist activity and threats. This log has been maintained from January 1989 to present (data for this plan was obtained January 2021), with all terrorist activity occurring between 1996 and 2020. While this is not a comprehensive source of all incidents in Centre County, it provides an inventory of events with which OES has been involved.

As shown in Table 4.3.22-1, 58 of 82 terrorism-related incidents occurred in 2001. Most of these events were for suspicious mail, packages or unknown white powder in 2001, which were later determined to be false alarms. Two specific incidents occurred in State College during the 2001 anthrax scare, one incident occurring at the Army Recruiting Station and another involving anthrax-threatening letters sent to a medical clinic. Since 2001, only 13 incidents related to terrorist activity occurred in Centre County, the majority of which involved bomb threats. Most recently, Penn State police reported several non-specific bomb threats from a single caller in 2012. Other incidents included threats to an abortion clinic and to an adoption agency mistaken for an abortion clinic, as well as other school bomb threats. Unfortunately, in 2019 an active shooter killed two people and injured two others just two miles from Penn State's main campus.

Though most of these incidents have also been unfounded, they still expend resources and require specialized training and equipment for emergency response personnel.

Table 4.3.22-1: Terrorist Activity Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
10/16/1996	Terrorist Activity	Bomb Threat	Benchmark Realty-College Twp.
11/1/1997	Terrorist Activity	Bomb Threat	S.C. Medical Services, (Abortion Clinic), S.C. Borough
8/18/1998	Terrorist Activity	Bomb Threat	Willowbank Bldg & Courthouse, Spring Twp.
4/1/1999	Terrorist Activity	Dry Ice Bombs	S.C. High School, State College Borough
5/13/1999	Terrorist Activity	Bomb Threat	Lowe's State College, Patton Twp.
11/10/1999	Terrorist Activity	Bomb Threat	S.C. H.S. North Bldg, State College Borough
1/29/2000	Terrorist Activity	Bomb Threat	553 Marjorie Mae St, St. College, Patton Twp.
9/11/2001	Terrorist Activity	WTC & Pentagon Attacks	New York City, Virginia, & Shanksville, Pa
9/22/2001	Terrorist Activity	Bomb Threat	Nittany Mall, S.C., College Twp.
10/12/2001	Terrorist Activity	Bag W/ Unknown Powder	Army Recruiting Center, 228 W. Coll. Ave, State College Boro
10/15/2001	Terrorist Activity	Suspicious Envelope	County Planning Office, Bellefonte Borough
10/15/2001	Terrorist Activity	White Powder in Envelope	477 E. Beaver Ave, S.C., State College Borough
10/15/2001	Terrorist Activity	White Powder in Envelope	Heart to Heart Adoption Center, Benner Township
10/17/2001	Terrorist Activity	Suspicious Envelope	Crabapple Drive, State College
10/17/2001	Terrorist Activity	Suspicious Envelope	112 Sandy Ridge Drive, State College
10/17/2001	Terrorist Activity	Suspicious Envelope	518 University Drive, State College
10/17/2001	Terrorist Activity	Suspicious Envelope	Bellefonte Post Office, Bellefonte Borough
10/18/2001	Terrorist Activity	Suspicious Envelope	1306 Linn Street, Bellefonte Borough
10/18/2001	Terrorist Activity	Suspicious Envelope	120 #5 S. Burrows Street, State College Borough
10/18/2001	Terrorist Activity	Suspicious Envelope	320 E. Bishop Street, Bellefonte Borough
10/18/2001	Terrorist Activity	Suspicious Envelope	325 S. Spring Street, Bellefonte Borough

Table 4.3.22-1: Terrorist Activity Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
10/18/2001	Terrorist Activity	Suspicious Package	126 Moore Bldg, University Park, State College Boro
10/18/2001	Terrorist Activity	Suspicious Package	155A Opp Bldg, University Park, State College Boro
10/18/2001	Terrorist Activity	White Powder W/ Video Game	240 N Allegheny St, Apt 1, Bellefonte Borough
10/19/2001	Terrorist Activity	Anthrax Suspicion	Centre Community Hospital, State College
10/19/2001	Terrorist Activity	Suspicious Envelope	1105 Plaza Drive, State College
10/19/2001	Terrorist Activity	Suspicious Package	Waring Commons, State College
10/19/2001	Terrorist Activity	Suspicious Vial	1214 Galen Drive, State College
10/19/2001	Terrorist Activity	White Powder on Parking Ticket	118 S Fraser St, State College Borough
10/20/2001	Terrorist Activity	Suspicious Envelope	805 W. Aaron Drive, S. C., Patton Twp.
10/20/2001	Terrorist Activity	Suspicious Envelope	301 Rolling Ridge Dr #514, S.C., College Twp
10/20/2001	Terrorist Activity	Suspicious Package	447 W. Clinton Ave # 1101, S.C., Ferguson Twp
10/21/2001	Terrorist Activity	Suspicious Envelope	508 W Lamb St, Bellefonte, Bellefonte Borough
10/21/2001	Terrorist Activity	White Powder in Book	Scpd, State College Borough
10/21/2001	Terrorist Activity	White Powder on Sidewalk	219 S. Sparks St, S.C., State College Borough
10/22/2001	Terrorist Activity	Suspicious Envelope	919 W Fairmont Ave., State College
10/23/2001	Terrorist Activity	Suspicious Envelope	201 Schemf Rd, Harris Twp.
10/23/2001	Terrorist Activity	Suspicious Package	118 S Fraser St, State College Borough
10/23/2001	Terrorist Activity	Suspicious Envelope	101 S Frear Bldg, University Park, State College Boro
10/23/2001	Terrorist Activity	Suspicious Magazine	201 #156 Vairo Blvd., Patton Twp.
10/24/2001	Terrorist Activity	Anthrax Suspicion	224 S Fraser St, State College Borough
10/24/2001	Terrorist Activity	Suspicious Envelope	137 W Curtin St, Bellefonte Borough
10/25/2001	Terrorist Activity	Suspicious Envelope	1981 Pine Hall Dr, Ferguson Twp.
10/25/2001	Terrorist Activity	Suspicious Envelope	349 #242 W. Clinton Ave, Ferguson Twp

Table 4.3.22-1: Terrorist Activity Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
10/27/2001	Terrorist Activity	Suspicious Envelope	424 J14 Waupelani Dr., State College Borough
10/29/2001	Terrorist Activity	White Powder	Potter Twp.
10/29/2001	Terrorist Activity	White Powder	Nittany Mall, S.C., College Twp.
10/31/2001	Terrorist Activity	Suspicious Envelope	24 Ag Sciences Bldg, Up, State College Borough
10/31/2001	Terrorist Activity	Suspicious Envelope	201 Old Main, Up, State College Borough
10/31/2001	Terrorist Activity	Suspicious Envelope	841 A Southgate Dr, State College
11/4/2001	Terrorist Activity	Suspicious Mail	Centre Community Hospital, State College
11/4/2001	Terrorist Activity	Suspicious Mail	446 Waupelani Dr, State College
11/5/2001	Terrorist Activity	Suspicious Mail	1850 E. Park Ave. S.C., College Twp.
11/5/2001	Terrorist Activity	Suspicious Mail	#208, 830 Cricklewood Dr., S.C., Patton Twp.
11/6/2001	Terrorist Activity	Suspicious Mail	2568 Park Center Blvd., Ferguson Twp.
11/6/2001	Terrorist Activity	Suspicious Mail	926 Outer Drive, S.C., Harris Twp.
11/8/2001	Terrorist Activity	Suspicious Activity - Vial	696 Tanager Dr., S.C., Ferguson Twp.
11/8/2001	Terrorist Activity	Suspicious Mail	1284 Avebury Circle., S.C., Ferguson Twp.
11/8/2001	Terrorist Activity	Suspicious White Powder on a Plant	2901 E College Ave., S.C., College Twp.
11/11/2001	Terrorist Activity	Suspicious Mail	1053 Greenfield Dr, S.C., State College Borough
11/13/2001	Terrorist Activity	Suspicious Mail	110 West Doris Ave., S.C., State College Borough
11/13/2001	Terrorist Activity	Suspicious Mail	315 S Allen St., S.C., State College Borough
11/13/2001	Terrorist Activity	Suspicious Mail	2310 Plaza Dr., S.C., State College Borough
11/15/2001	Terrorist Activity	Suspicious Mail	1050 E. College Ave.,
11/15/2001	Terrorist Activity	Suspicious Mail	270 Walker Dr.
3/21/2002	Terrorist Activity	White Powder	110 E Foster Ave, S.C., State College Borough
3/27/2002	Terrorist Activity	Oil Spill	Moshannon Creek, Centre/Clearfield Counties
4/11/2003	Terrorist Activity	Bomb Threat	No Details Provided

Table 4.3.22-1: Terrorist Activity Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
10/18/2006	Terroristic Threats	Bomb Threat	Bellefonte High School, Spring Twp.
10/25/2006	Terroristic Threats	Bomb Threat	Bellefonte Middle School, Spring Twp.
10/25/2006	Terroristic Threats	Terroristic Threats	Bellefonte High School, Spring Twp.
10/30/2006	Terroristic Threats	Bomb Threat	Bellefonte Middle School, Spring Twp.
11/2/2006	Terroristic Threats	Bomb Threat	Upa, Benner Twp.
11/12/2007	Terrorist Activity	Bomb Threat	Bellefonte H S, Bellefonte Borough
11/30/2007	Terrorist Activity	Bomb Threat	Philipsburg Osceola Junior High School, Philipsburg Boro
11/30/2007	Terrorist Activity	Bomb Threat	Philipsburg Osceola High School, Philipsburg Boro
6/25/2012	Terrorist Activity	Non-Credible Bomb Threats	PSU Campus, State College Borough
5/24/2015	Terrorist Activity	Explosives Found	3315 E. College Avenue, College Township
11/16/2018	Terroristic Threats	Bomb Threats	Nationwide email threats
5/20/2018	Terrorist Activity	Improvised Explosive Device Found	Blair County Request for bomb squad response at a police range
1/24/2019	Terrorist Activity	Active Shooter	State College Ramada, College Township
9/23/2020	Terrorist Activity	Bomb Squad Response	Match factory, Bellefonte Borough

4.3.22.4 Future Occurrence

An important consideration in estimating the likelihood of a terrorist incident is the existence of facilities, landmarks, or other buildings of national or regional importance. As previously noted, aside from Penn State University, there are no sites which are considered significant landmarks in terms of national or international importance. The potential threat of an incident occurring during a major event such as a football game or the Arts Festival is greater, while the many notable landmarks from a local historic perspective throughout the County are less at risk.

Based on historical events, Centre County can expect to experience several suspected terrorist incidents or threats each year. Although previous events have not resulted in what are considered significant terrorist attacks, the severity of a future incident cannot be predicted with a sufficient level of certainty. Prediction of terrorist attacks is almost impossible because terrorism is a result of human factors. As long as fringe groups maintain radically different ideas than that of the government or general population, terrorism is a possibility. Overall, the

likelihood of a terrorist attack is considered *unlikely* as defined by the Risk Factor Methodology (See Section 4.4-1).

4.3.22.5 Vulnerability Assessment

Since the probability of terrorism occurring cannot be quantified in the same way as that of many natural hazards, it is not possible to assess vulnerability in terms of likelihood of occurrence. Instead, vulnerability is assessed in terms of specific assets. By identifying potentially at-risk terrorist targets in Centre County, planning efforts can be put in place to reduce the risk of attack. All communities in Centre County are vulnerable on some level, directly or indirectly, to a terrorist attack. However, communities where the previously mentioned potential targets are located should be considered more vulnerable. FEMA's Integrating Manmade Hazards into Mitigation Planning (2003) encourages site-specific assessments that should be based on the relative importance of a particular site to the surrounding community or population, threats that are known to exist, and vulnerabilities including:

Inherent Vulnerability

- Visibility – How aware is the public of the existence of the facility?
- Utility – How valuable might the place be in meeting the objectives of a potential terrorist?
- Accessibility – How accessible is the place to the public?
- Asset mobility – is the asset's location fixed or mobile?
- Presence of hazardous materials – Are flammable, explosive, biological, chemical and/or radiological materials present on site? If so, are they well secured?
- Potential for collateral damage – What are the potential consequences for the surrounding area if the asset is attacked or damaged?
- Occupancy – What is the potential for mass casualties based on the maximum number of individuals on site at a given time?

Tactical Vulnerability

Site Perimeter

- Site planning and Landscape Design – Is the facility designed with security in mind – both site-specific and with regard to adjacent land uses?
- Parking Security – Are vehicle access and parking managed in a way that separates vehicles and structures?

Building Envelope

- Structural Engineering – Is the building's envelope designed to be blast-resistant? Does it provide collective protection against chemical, biological, and radiological contaminants?

Facility Interior

- Architectural and Interior Space Planning – Does security screening cover all public and private areas?
- Mechanical Engineering – Are utilities and Heating, Ventilating and Air Conditioning (HVAC) systems protected and/or backed up with redundant systems?
- Electrical Engineering – Are emergency power and telecommunications available? Are alarm systems operational? Is lightning sufficient?
- Fire Protection Engineering – Are the building's water supply and fire suppression systems adequate, code-compliant, and protected? Are on-site personnel trained appropriately? Are local first responders aware of the nature of the operations at the facility?
- Electronic and Organized Security – Are systems and personnel in place to monitor and protect the facility?

Centre County has in place a mutual aid and cooperation agreement with Bedford, Blair, Fulton, Huntingdon, Juniata, Mifflin, and Snyder Counties to continue the South Central Mountains Regional Task Force (PEMA, n.d.). The task force was formed in 1998 in response the growing threat of the use of Weapons of Mass Destruction (WMDs). Key programs include planning and exercising in preparation for a large-scale hazardous event, training specialized response teams, and purchasing response and recovery equipment. The task force counties assist each other in the event of an emergency or disaster. In 2013, the Centre County Board of Commissioners, following a statewide directive, provided trainings to local emergency personnel to increase readiness in the area's emergency response teams to acts of terrorism – largely focusing on the response to weapons of mass destruction (biological, chemical, or nuclear attack) (Gilmore, 2013).

Sites that may potentially be vulnerable to terrorist attacks include the following:

- Township of Benner – Airports, and Rockview and SCI Benner Prison Facilities
- Township of Boggs – Transportation Corridor (I-80)
- Township of College – Penn State University Sports Complexes
- Township of Ferguson – High Technology Business Parks
- Township of Liberty – Foster Joseph Sayers Dam
- Borough of Bellefonte – County Facilities
- Borough of Centre Hall – Grange Fair Event
- Borough of State College – Penn State University Facilities

4.3.23 Transportation Accidents

4.3.23.1 Location and Extent

For this analysis a transportation accident is defined as an incident involving highway, air, or rail travel. Accidents involving hazardous materials are considered under Section 4.3.17 of this report. This analysis includes the location of all public airports, passenger and freight rail lines, and highways where major accidents are likely to occur.

Within Centre County, there are over 1,500 miles of roads and 489 bridges (PennDOT, 2019b; PennDOT, 2020a). A total of 28 of these bridges (5.7 percent) are classified as in poor condition by PennDOT. Key freight routes include I-80, I-99, and US 322, SR-26, US 220. In 2019, PennDOT statistics indicated over 4 million daily vehicle miles traveled within Centre County. The Nittany and Bald Eagle Railroad serves the Bald Eagle Valley and Bellefonte area, for a total track length of 60 miles. There is a potential for major accidents on any of these roads, bridges or railways.

There are five airports within the jurisdiction of Centre County. Only University Park Airport is used by commercial airlines, the other four are private. Numerous major air traffic routes for the northern United States also pass over Centre County. Figure 4.3.24-1 illustrates the major transportation systems in the County while Figure 4.3.24.2 shows the traffic volume on key roadways.

4.3.23.2 Range of Magnitude

At a minimum, transportation accidents can result in damage to the vehicles and minor injuries to passengers and drivers. At worst, significant transportation accidents can result in death or serious injury or extensive property loss or damage coupled with business interruptions and hours of congestion. Road 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.

The worst-case scenario for a transportation accident impacting Centre County would be a road accident which results in a hazardous material spill in a densely population area, such as near the Penn State University campus. Such an event would constitute an immediate health hazard to the university population and require an evacuation of campus.

Figure 4.3.23-1: Centre County Transportation Systems, 2020

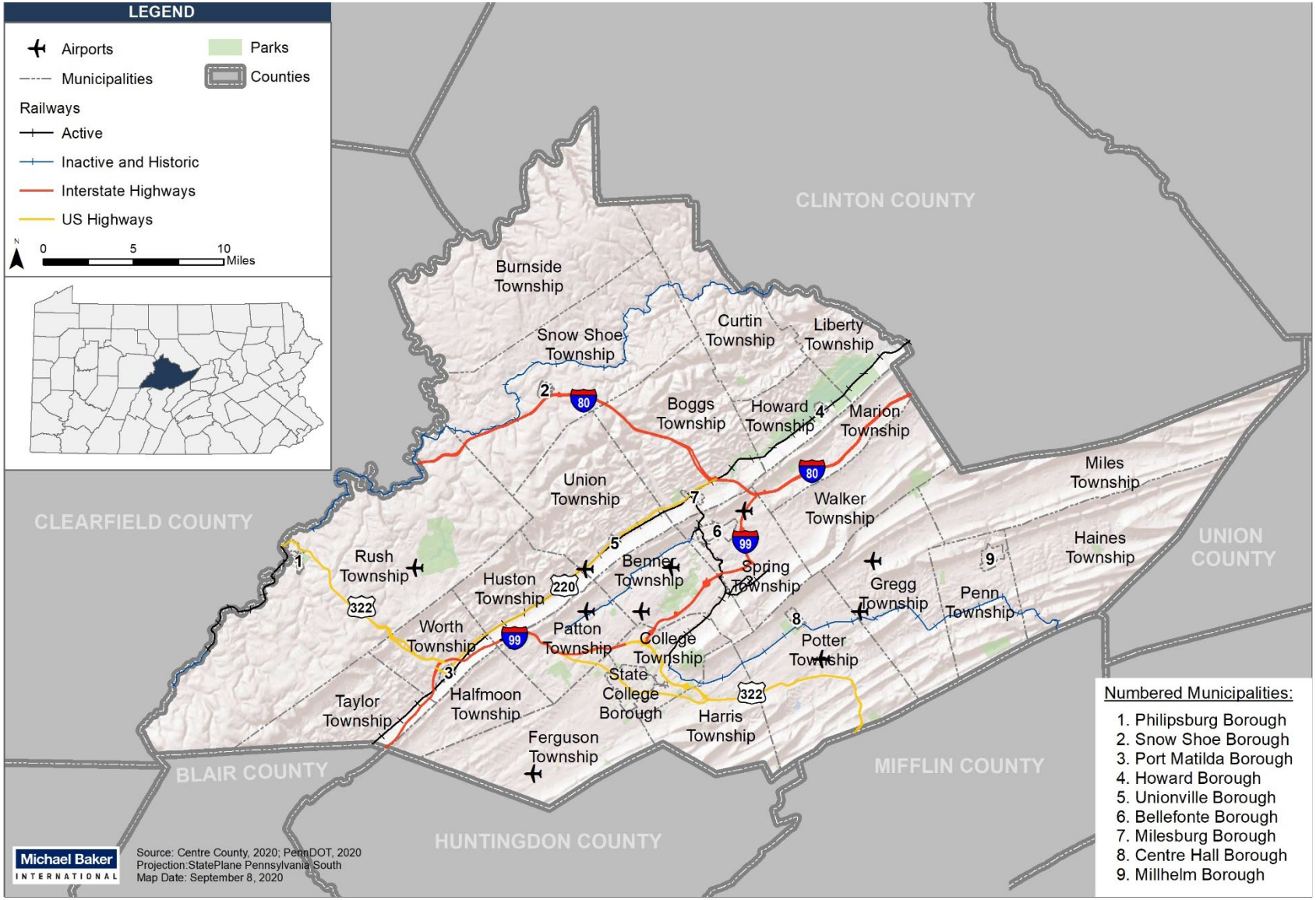
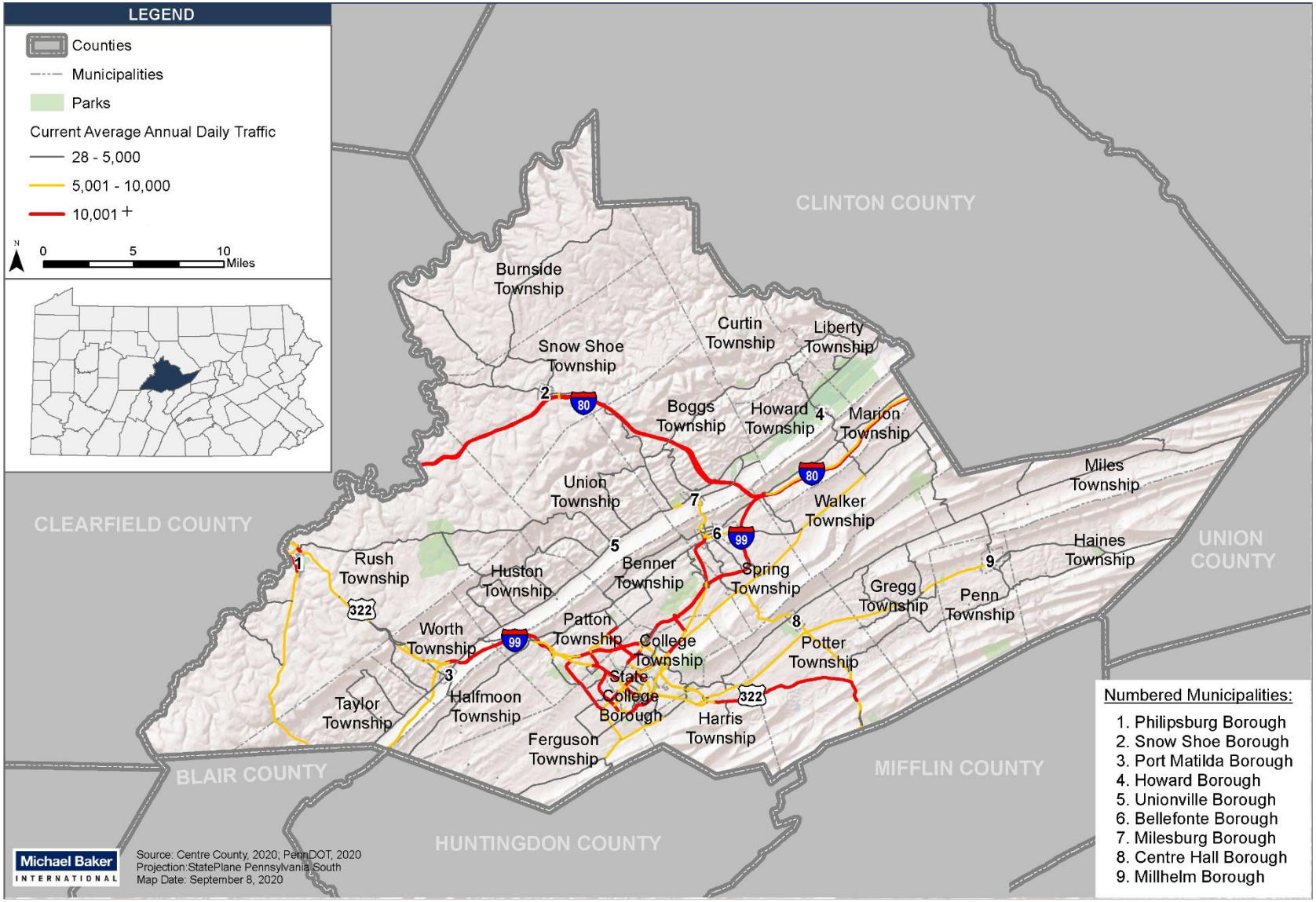


Figure 4.3.23-2: Centre County Traffic Volume on Key Roadways, 2020



4.3.23.3 Past Occurrence

Vehicle crashes continues to be a risk throughout the County. PennDOT statistics for reportable vehicle crashes in Centre County are shown in Table 4.3.23-1.

Table 4.3.23-1: Reportable Traffic Crash Data, 2009-2019 (PennDOT, 2019c).

YEAR	REPORTABLE CRASHES	# FATAL CRASHES	# PERSONS KILLED	# INJURY CRASHES
2009	1,262	12	13	618
2010	1,208	11	11	621
2011	1,320	18	18	618
2012	1,287	13	14	596
2013	1,242	11	12	557
2014	1,210	11	12	552
2015	1,301	15	15	577
2016	1,311	20	20	558
2017	1,248	15	16	503
2018	1,217	12	13	532
2019	1,189	1	1	493

Figure 4.3.23-3 shows the density of transportation crashes throughout Centre County. Red and yellow areas show roadways where the most crashes occurred between 2015 and 2020. In Centre County, most accidents occur along Routes I-80 and I-99, and SR 322. Crashes are also densely concentrated around the more populated communities in the southern portion of the County. Municipalities in the Centre Region such as College Borough, Ferguson Township, and State College Borough have areas with dense incidents of transportation crashes.

Pedestrian accidents remain a noted concern. The Penn State University Safety Council in 2007 presented insight into the concern for pedestrian safety in and around campus where large volumes of both foot and vehicular traffic interact. From 2004-2007, a total of 24 reported pedestrian accidents were reported to Penn State. It was further found that 33 percent were employees and 33 percent of incidents occurred within crosswalks (only 3 reported at mid-block). Most accidents occurred during working hours and issues of divided attention, both for pedestrians and drivers was cited as a contributing factor. Reviewing incident data from the last five years, it appears that the number of annual pedestrian injuries has roughly stayed the same since the last plan in 2015 (ranging from 32-49 incidents) (see Table 4.3.23-2).

Figure 4.3.23-3: Centre County Transportation Crash Density, 2015-2020

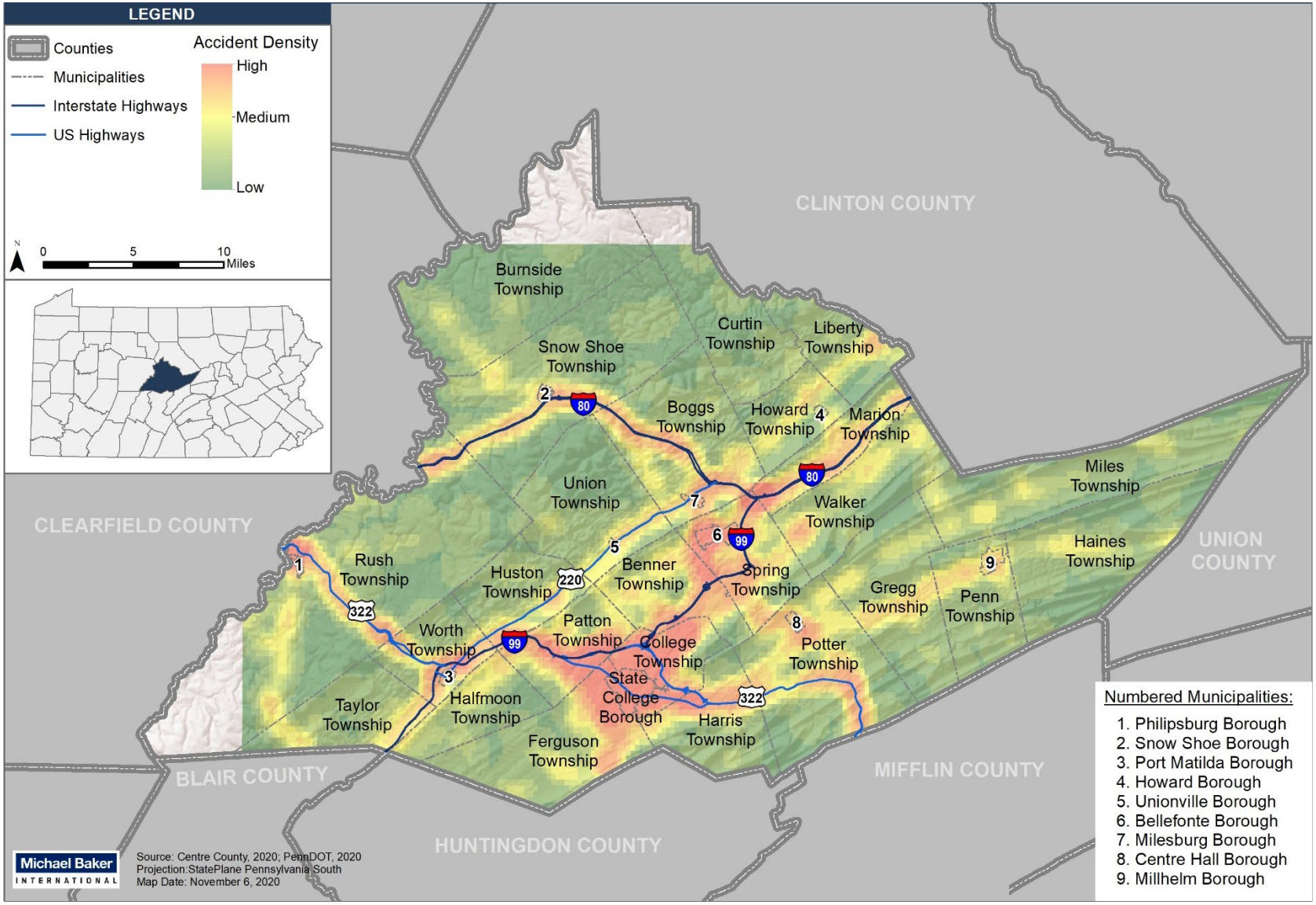


Table 4.3.23-2: Total Pedestrian Deaths and Injuries in Centre County by Age Group 2009-2014 (PennDOT, 2019c).

YEAR	TOTAL PEDESTRIAN DEATHS	AGE 0-4		AGE 5-9		AGE 10-14		AGE 15-59		AGE 60+	
		DEATH	INJURY	DEATH	INJURY	DEATH	INJURY	DEATH	INJURY	DEATH	INJURY
2009	3	0	1	0	1	0	1	3	45	0	1
2010	1	0	0	0	1	0	1	0	40	1	1
2011	1	0	0	0	0	0	3	0	34	1	4
2012	0	0	1	0	0	0	0	0	44	0	3
2013	1	0	1	0	0	0	1	1	31	0	5
2014	2	0	1	1	0	0	0	1	38	0	3
2015	1	0	0	0	0	1	2	0	23	0	7
2016	3	0	0	0	2	0	1	1	38	2	2
2017	1	0	0	0	0	1	2	0	23	0	7
2018	0	0	0	0	0	0	0	0	44	0	4
2019	0	0	0	0	0	0	0	0	39	0	9

Seventy-five (75) transportation accidents and/or incidents were also identified in Centre County OES's incident log from September 2015 through January 2021. As previously noted, this log has been maintained since 1989. From 1989 to January 2021, there were 214 transportation incidents reported on this log. While this is not a comprehensive source of all incidents in Centre County, it provides an inventory of events where the OES has been involved. Table 4.3.23-3 provides details on incidents reported since 2010. As shown in the table, incidents have involved aircrafts and railroad, as well as motor vehicles or trucks. Additionally, many of the accidents involving trucks resulted in the release of hazardous materials.

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
9/5/2011	Transportation	Air Craft Incident	University Park Airport, Benner Twp.
1/11/2012	Transportation	Vehicle Accident	I-80, Near Exit 147, Snow Shoe Twp.
2/17/2012	Transportation	Gasoline Tanker	Grays Woods, Patton Twp
3/18/2012	Transportation	Vehicle Accident W/ Road Closure	I-99, Worth Twp.
3/29/2012	Transportation	Vehicle Accident W/ Road Closure	Sr-150 In Howard Twp.
4/3/2012	Transportation	Vehicle Accident W/Road Closure	Rt.322, Rush Twp.
4/11/2012	Transportation	Sewage Spill	Rt. 144, Spring Twp.
7/27/2012	Transportation	Military Rocket	I-99 At Shiloh Road Southbound Off Ramp
8/6/2012	Transportation	Vehicle Accident W/Fatality	Sr-150, Benner Twp.

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
8/9/2012	Transportation	Vehicle Accident W/Fatality	Alt 220, Union Twp. @ Jacobs Road
8/10/2012	Transportation	Vehicle Accident W/Fatality	I-99 At Shiloh Road, College Twp.
8/13/2012	Transportation	Aircraft Incident	University Park Airport, Benner Twp.
9/1/2012	Transportation	Vehicle Accident W/Fatality	Rt. 322, College Twp.
9/28/2012	Transportation	Vehicle Accident	I-80 E., Mm158, Boggs Twp.
2/26/2013	Transportation	Aircraft Emergency	University Park Airport, Benner Twp
1/7/2014	Transportation	Aircraft Emergency	Upa, Benner Twp
6/22/2014	Transportation	Vehicle W/ Road Closure	Port Matilda Rd, Rush Twp.
2/2/2015	Transportation	Vehicle Accident W\Fatality	Rte. 26, College Twp.
2/11/2015	Transportation	Milk Tanker	Walker Twp.
2/12/2015	Transportation	Multi-Vehicle W/ Road Closure	I-80, Mm 161Eb, 162-164 Wb, Marion Twp
2/21/2015	Transportation	Road Closure Vehicle Fire	Rte 322 Wb, Potter Twp
2/22/2015	Transportation	Rr Crossing Collision	South Eagle Valley Rd, Snyder Twp, Blair Cty
2/25/2015	Transportation	Vehicle Fire / Road Closure	I-80 Wb, Mm 148, Snow Shoe Twp
5/23/2015	Transportation	T&T Rollover W/ Lane Restriction	I-99, Mm 78.0, Benner Twp
5/24/2015	Transportation	Road Closure Vehicle Accident W/ Fatality	Rte 144 & Bible Rd, Potter Twp
7/14/2015	Transportation	Oil Spill	11954 Eagle Valley Rd, Taylor Twp
12/30/2015	Transportation	Road Closure W/ Fatality	I-80 Wb, Mm183.5, Rush Twp.
1/5/2016	Transportation	Aircraft Accident W/ No Injuries	UPA, Benner Twp.
5/18/2016	Transportation	Aircraft Accident W/ 2 Fatalities	Barns Lane, UPA, Benner Twp.
10/21/2016	Transportation	Glider Plane	Eagle Field Rd, Patton Twp.
11/5/2016	Transportation	Tractor Trailer Pile Up W/ Fatalities	I-80 Eb, Near Exit 161, Betw Blf & Lamar, Marion Twp.
1/11/2017	Transportation	Tractor Trailer Roll Over	I-80 Eb Mm 152, Bogss Twp
2/11/2017	Transportation	Multiple Vehicle Crash	I-99 Port Matilda
4/17/2017	Transportation	Aircraft Emergency Level Ii	University Park Airport, Benner Twp
5/1/2017	Transportation	Petroleum Product	I 80 Wb, Exit 161, Marion Twp.
5/3/2017	Transportation	Tractor Trailer Fire	I 80 Eb, Mm 162, Marion Twp.

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
5/27/2017	Transportation	Vehicle Accident	I 80 Off Ramp
1/11/2018	Transportation	Multiple Vehicle Crash, Road Closure	Sr 322, Potter Twp. Construction Zone
1/25/2018	Transportation	Crash	Sr 45 Road Closure
2/4/2018	Transportation	Multiple Crashes, Road Closure	Sr 350, Rush Twp.
3/2/2018	Transportation	TT Fire, Mail Truck, Trapped Queue	I-80, Eb. Mm 146 Snow Shoe Twp.
3/8/2018	Transportation	TT Crash, Rolled Over Hillside, Fuel Spill	I-80 Eb Mm 151, Boggs, Recovery Caused Closure On 03/15
3/11/2018	Transportation	TT Fire, Closure, Trapped Queue	I-99, Nb, Taylor Twp.
3/13/2018	Transportation	TT Crash, Reported as Hazmat, No Spill	I-80 Wb, Mm 139 Rush Twp.
4/5/2018	Transportation	TT Fire, Fuel Spill, Road Closure, Trapped Queue	I-80 Wb Mm 152 Boggs Twp. , Fire Consumed Fuel Spill
4/13/2018	Transportation	Crash With Ejections, Road and Rr Closed	Alt 220, Union Twp.
4/21/2018	Transportation	TT Rollover, Hazmat - Glycerin, Closure, Trapped Queue	1-80 Wb Mm 153 Boggs Twp
4/22/2018	Transportation	TT Fuel Spill, Ruptured Tank	I-80 Wb Mm 142, Rush Twp.
4/30/2018	Transportation	TT Versus Mc Fatal Crash, Road Closure	I-80 Wb Mm157, Boggs Twp.
5/1-3/2018	Transportation	TT Fire, Road Closure, Trapped Queue	Sr 26-150, College Twp.
5/2/2018	Transportation	TT Fire, Road Closure, Trapped Queue	I-80 Eb Mm 161, Marion Twp.
5/4/2018	Transportation	TT Rollover, Hazmat - Fuel Spill Next to Stream	Beaver Rd. At Mudlick Rd., Union Twp.
5/4/2018	Transportation	Road Closure, Crash Amish Buggy Vs. Mc, Fatal	Sr 880, Miles Twp.
5/4/2018	Transportation	TT Fire -Crash, Road Closure, Trapped Queue	I-80 Eb Mm 158, Boggs Twp.
5/21/2018	Transportation	Crash into Pole and House, Road Closure, Power Outage	Sr 26, Pleasant Gap, Spring Twp.
5/21/2018	Transportation	TT Into Building, Adjacent Hazmat - No Spill	Sr 26, Howard Uni Mart, Howard Boro

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
5/22-23/2018	Transportation	TT Rollover Crash	I-80 Wb, Mm154, Road Closure - Trapped Queue
6/10/2018	Transportation	Road Closure - Structure Fire	Sr 350, Rush Twp.
7/4-6/2018	Transportation	Rv Fire, Trapped Queue	Sr 322, 7 Mts. Construction, Potter Twp.
7/22/2018	Transportation	TT Crash, Fire, Reported Hazmat - None	I-80 Wb, Mm 160, Boggs Twp.
8/1/2018	Transportation	TT Crash, Road Closure	I-99, Nb, Benner Twp.
8/9/2018	Transportation	TT Crash, Road Closure, Trapped Queue	I-80 Wb Mm 144, Snow Shoe Twp.
8/13/2018	Transportation	Vehicle Fire, Fuel Spill	Sr 26, College Twp.
8/13-14/2018	Transportation	TT Rollover Hill, Hazmat - Fuel Spill, Removal	I-80 Eb Mm 139, Rush Twp.
8/15/2018	Transportation	Fatal Crash, Road Closure	Sr 45 Miles Twp.
8/18/2018	Transportation	2 Fatal Crash, Road Closure	Sr 53, Snow Shoe Twp.
8/23/2018	Transportation	Road Closure, Crash -Psp Pursuit, Recon.	Sr 322 At Sr 144, Potter Twp.
9/10/2018	Transportation	Road Closure, Fatal Crash, Trapped Queue	Sr 322, College Twp.
10/11/2018	Transportation	Fatal Crash, Road Closure, Trapped Queue	Sr 322, Potter Twp. Construction Zone
11/1/2018	Transportation	Road Closure, Fatal Crash	Sr 45, Potter Twp.
11/15/2018	Transportation	Road Closure, Fatal Crash, Trapped Queue	Sr 322 & Sr 144, Potter Twp.
11/21/2018	Transportation	2 TT Crash, Hazmat - Fuel Spill, Life Flight	I -80, Eb, Mm 148, Snow Shoe Twp.
12/19/2018	Transportation	Crash - Clearfield Co. Backlog, Detour	I-80, Sr 144/53 Detour, Snow Shoe Twp., Burnside Twp.
12/20/2018	Transportation	Road Closure, Fatal, Detour	Sr 322, Philipsburg Boro
12/24/2018	Transportation	Road Closure	Sr 350, Rush Twp.
1/19/2019	Transportation	TT Crash, Fuel Spill, Road Closure - Hazmat	I-80 Eb Mm 158, Boggs Twp.
1/24/2019	Transportation	TT Crash, Fuel Spill, Road Closure - Hazmat	I-99, Sb Mm 61, Off Ramp, Worth Twp.
2/11/2019	Transportation	Train Hit TT Stopped on Tracks, No Injuries or Spill, Coal Train	Aqua Penn Dr. Boggs Twp.

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
2/13/2019	Transportation	TT Rollover, Spilled Cargo - Env. Hazard	I-80 Eb Mm 167.8, Marion Twp.
2/15/2019	Transportation	Leaking Fuel Tank	Sr 322, Wb, 7 Mts. Also Mifflin - Juniata Co.S
2/25/2019	Transportation	2 TT Crash, Fire, Reported Hazmat, Road Closure	I-80 Wb, Mm 150, Boggs Twp.
3/15/2019	Transportation	TT Rollover, Damage to Bridge, Minor Fuel Spill	I-99 Sb Over Sr 144, Mm 80
6/19/2019	Transportation	Sr 45 Closure, Cart Assist - Cattle	Union Co. Just Over County Line, Cart Coordinated
6/8/2020	Transportation	2 TT crash, fuel spill	I-80, Wb Mm 154, Boggs Township
6/10/2020	Transportation	SR 144 closed, truck crash into house-fire	SR 144, Potters Mills, Potter Township
6/12/2020	Aircraft	Alert 3, crash level A, plane slid off runway	UPA, Benner Township
6/15/2020	Transportation	Multi vehicle crash	I-80, 166 Wb, Marion Township
7/8/2020	Transportation	2 vehicle crash, road closure	I-80, Wb Mm 159, Boggs Township
7/19/2020	Aircraft	Alert 1	UPA, Benner Township
7/25/2020	Transportation	Crash, TT rollover and spill	I-80, Eb Mm 163, Marion Township
8/15/2020	Transportation	Fatal crash into bridge, road closed	I-99, Mm 76, Spring Township
8/26/2020	Transportation	Vehicle crash, runaway track ramp, road closure	Pine Grove Mountain, Ferguson Township
9/19/2020	Transportation	Multi vehicle crash, entrapment, road closure	I-99, Eb & Wb, Spring Township
9/21/2020	Transportation	TT crash, rollover, fuel spill	I-99 at I-80 Eb off ramp, Spring Township
9/29/2020	Transportation	TT crash, rollover, fuel spill	I-80, Eb Mm 162, Marion Township
10/12/2020	Transportation	Head on fatal crash, 6 hour road closure	SR 322, Potter Township
10/12/2020	Transportation	2 TT fatal crash, fuel spill, 12 hour road closure	I-80, I-99 on ramp, Eb, Boggs Township
10/22/2020	Transportation	TT rollover and fuel spill	I-80 Eb off ramp, SR 150, Boggs Township
11/13/2020	Transportation	2 vehicle fatal head on crash, road closure	I-99, Patton Township
11/17/2020	Transportation	TT struck debris causing fuel leak	I-80, Wb Mm 169, Marion Township

Table 4.3.23-3: Transportation Accidents Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
1/8/2021	Transportation	Large vehicle fire, road closure	I-80, Eb Mm 152, Boggs Township

Additionally, during the 2015 planning process, stakeholders highlighted the following with respect to past transportation accidents:

- There were increased traffic accidents on the Benner Pike.
- There have been traffic accidents along Route 192 near the Miles Township and Gregg Township line, including several in the past few years along a straight stretch of roadway.
- Route 322 in Rush Township and Philipsburg Borough is accident prone. There is no alternate route nor turning area if an accident occurs.
- I-99 has an increased risk of hazardous materials incidents.

Since 2015, CCMPO conducted stakeholder meetings with all 35 municipalities to gather input about transportation needs CCMPO's new Centre County Long Range Transportation Plan 2050, which was adopted in September 2020. The input gathered from stakeholders identified a number of locations where crashes occur, and numerous other safety concerns. For additional information on these locations, please refer to the Centre County Long Range Transportation Plan 2050.

4.3.23.4 Future Occurrence

Growth in the urbanized area of Centre County fueled by Penn State University and by increasing commercial business and enterprises with related housing growth has also contributed to large increases in traffic on the major roads serving commuter traffic from Centre County and the surrounding counties. The number of transportation related accidents is expected to increase with this projected growth. Recognizing the changing transportation network within the County and the steadily growing transportation volume, the number of accidents and resulting deaths, injuries, environmental impacts and property damages are expected to rise. The expected increases in transportation related responses require specialized training and equipment to be maintained at a high level of preparedness. The future occurrence of transportation accidents can be considered *likely*, according to the Risk Factor Methodology (see Table 4.4-1).

4.3.23.5 Vulnerability Assessment

A transportation-related incident can occur on any stretch of road in Centre County. However, severe accidents are more likely on the County's highways, which 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. Accidents may also occur on any rail line or air flight path.

Because of the widespread transportation network in Centre County, a large number of structures are exposed to the threat of transportation accidents. Tables 4.3.23-4, 4.3.23-5, and

4.3.23-6 show the structures, critical facilities (excluding oil and gas wells), and populations vulnerable to transportation accidents on roads, railroads, and near airports in Centre County. No conventional or unconventional oil and gas wells are in areas vulnerable to transportation incidents.

The communities most at risk are Unionville and Port Matilda Boroughs. In Unionville Borough, 95.52 percent of structures are located within 0.25 miles of a major highway, 91.79 percent are located within 0.25 miles of an active rail line, and 100 percent are located within five miles of an airport. In Port Matilda Borough, 100 percent of structures are located within 0.25 miles of a major highway, 82.42 percent are located within 0.25 miles of an active rail line, and 100 percent are located within five miles of an airport. Additionally, 100 percent of critical facilities in Port Matilda Borough are located in areas vulnerable to transportation accidents on roads, railroads, and near airports. Almost all communities in Centre County have more than 80 percent of their population living less than 0.25 miles from a major highway, as shown in Table 4.3.23-6.

The County and local municipalities have taken a number of steps to improve safety and reduce the risk of traffic accidents, with some project focused specifically on accidents involving pedestrians.

- In 2014, the County was awarded $1.8 million from PennDOT to improve bicycle and pedestrian safety. The majority of the County's funding was awarded to College and Ferguson Townships through two grants totaling $946,880 and $777,753, respectively. The funds were used to improve bicycle and pedestrian connections in the townships, address issues of flooding and stormwater management, and relocate and construct utilities. Grant funds were also awarded to the Centre Area Transportation Authority for lighting and safety improvements at high-volume stops in Ferguson Township (Hartley, 2014).
- In late 2014, State College Borough began construction of a number of sidewalk "bump outs" to improve pedestrian safety throughout the downtown (Weston, 2014). Sidewalk bump outs extend the sidewalk into the street to allow pedestrians to better see oncoming traffic, reduce crossing distances, and slow-moving vehicles due to a narrowing of the roadway.
- State College Borough's police department launched an ongoing public awareness initiative during the 2015 HMP process, including the installation of electronic signs along the downtown thoroughfare; the distribution of materials on the Penn State University campus; and public service announcements on local radio stations (CCPCDO, 2019b).
- In 2015, improvements were made to the Circleville Road bike path in Patton Township. The Township plans to continue making connections and improvements along this path to enhance its bicycle network (CCMPO, 2020b).
- In 2017, construction began on three pedestrian and bicycle safety improvement projects in the County (CCMPO, 2020b):

  - College Township: Puddintown to Orchard Bike Connector
  - Ferguson Township: CATA Bus Stop Lighting and Safety Improvements
  - Ferguson Township: W. College Ave. Sidewalk Improvements

- In 2017, PennDOT committed $3 million in funding to update and "refresh" data originally collected for the South Central Centre County Transportation Study, which was terminated in 2004 due to funding shortfalls. The update was completed in 2019, and is currently being used by PennDOT to identify, evaluate, and select an alternative that addresses safety and congestion needs on the Route 322/144/45 Corridors in Centre County (CCPCDO, 2019b).
- In February 2018, College Township was awarded $42,524 from PennDOT to improve traffic safety with Red Light Enforcement Funds. Funds were used to improve safety by changing the northbound left turn at the intersection of Park Avenue and I-99 southbound/U.S. 322 westbound on-ramp to a dedicated protected left-turn operation (PennDOT, 2018).
- In October 2018, Centre County was awarded $1.365 million from the PennDOT Multimodal Transportation Fund. Funds will be used for bridge rehabilitation and replacement across the county. Three locally owned township bridges are slated for major rehabilitation; T-526 Fox Gap Road over Elk Creek (Miles Township), T-489 Front Street over Beech Creek (Curtin Township), and T-942 Lower Coleville Road over Buffalo Run (Spring Township).
- In February 2019, Centre County was awarded an additional $2.070 million from the PennDOT Multimodal Transportation Fund, which will be used to replace two locally owned bridges; Railroad Street Bridge (Bellefonte Borough), and Mill Street Bridge (Howard Borough) (CCPCDO, 2019b).
- PennDOT was awarded $35 million in 2018 through the federal Infrastructure for Rebuilding America Grant (INFRA). This grant will fund the construction of a new interchange between Route 26 and I-80 near milepost 163 (local access interchange), which is needed to facilitate the construction of a new high-speed interchange between I-80 and I-99. The interchange will replace the current indirect connection along SR-26, include ITS fiber for traffic monitoring devices, and provide conduit to support Penn State's autonomous vehicle program. The existing interchange is not designed for current volumes and speeds; the new interchanges will mitigate the occurrence of vehicle incidents. The INFRA grant funds leverage another $150 million from PennDOT to meet the $185 million needed for project completion (Thompson, 2018).

Table 4.3.23-4: Structures Vulnerable to Transportation Accidents

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT STRUCTURES WITHIN 0.25 MILES OF MAJOR HIGHWAY	STRUCTURES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT STRUCTURES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	TOTAL STRUCTURES WITHIN 5 MILES OF AIRPORT	PERCENT STRUCTURES WITHIN 5 MILES OF AIRPORT
Bellefonte Borough	2,658	2,456	92%	830	31%	2,658	100%
Benner Township	2,369	1,535	65%	418	18%	2,369	100%
Boggs Township	1,598	1,288	81%	417	26%	1,054	66%
Burnside Township	441	241	55%	0	0%	0	0%
Centre Hall Borough	579	557	96%	167	29%	579	100%
College Township	4,810	3,715	77%	1,123	23%	4,529	94%
Curtin Township	448	141	31%	68	15%	0	0%
Ferguson Township	6,949	2,475	36%	0	0%	5,114	74%
Gregg Township	1,179	784	66%	309	26%	1,156	98%
Haines Township	1,003	522	52%	39	4%	0	0%
Halfmoon Township	1,089	354	33%	0	0%	964	89%
Harris Township	2,798	2,230	80%	62	2%	133	5%
Howard Borough	298	283	95%	181	61%	0	0%
Howard Township	523	263	50%	153	29%	137	26%
Huston Township	684	517	76%	267	39%	684	100%
Liberty Township	1,233	658	53%	197	16%	0	0%
Marion Township	501	396	79%	0	0%	163	33%
Miles Township	944	564	60%	0	0%	33	3%
Milesburg Borough	475	427	90%	258	54%	475	100%
Millheim Borough	427	416	97%	0	0%	0	0%
Patton Township	5,315	2,571	48%	124	2%	5,315	100%
Penn Township	881	327	37%	203	23%	121	14%
Philipsburg Borough	1,309	1,279	98%	509	39%	0	0%

Table 4.3.23-4: Structures Vulnerable to Transportation Accidents

MUNICIAPLITY	TOTAL STRUCTURES	STRUCTURES WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT STRUCTURES WITHIN 0.25 MILES OF MAJOR HIGHWAY	STRUCTURES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT STRUCTURES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	TOTAL STRUCTURES WITHIN 5 MILES OF AIRPORT	PERCENT STRUCTURES WITHIN 5 MILES OF AIRPORT
Port Matilda Borough	256	256	100%	211	82%	256	100%
Potter Township	2,015	1,122	56%	164	8%	2,008	100%
Rush Township	2,462	1,717	70%	347	14%	646	26%
Snow Shoe Borough	346	325	94%	0	0%	0	0%
Snow Shoe Township	1,347	766	57%	221	16%	0	0%
Spring Township	3,654	2,391	65%	1,524	42%	3,654	100%
State College Borough	6,861	4,860	71%	0	0%	5,859	85%
Taylor Township	497	282	57%	72	14%	0	0%
Union Township	775	474	61%	201	26%	680	88%
Unionville Borough	134	128	96%	123	92%	134	100%
Walker Township	2,038	1,428	70%	0	0%	1,450	71%
Worth Township	471	266	56%	73	15%	395	84%
Total	**59,367**	**38,014**	**64%**	**8,261**	**14%**	**40,566**	**68%**

Table 4.3.23-5: Critical Facilities Vulnerable to Transportation Accidents

MUNICIPALITY	TOTAL CRITICAL FACILITIES	FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	FACILITIES WITHIN 5 MILES OF AIRPORT	PERCENT FACILITIES WITHIN 5 MILES OF AIRPORT
Bellefonte Borough	17	16	94%	7	41%	16	94%
Benner Township	26	10	38%	3	12%	22	85%
Boggs Township	9	7	75%	6	67%	7	78%

Table 4.3.23-5: Critical Facilities Vulnerable to Transportation Accidents

MUNICIPALITY	TOTAL CRITICAL FACILITIES	FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	FACILITIES WITHIN 5 MILES OF AIRPORT	PERCENT FACILITIES WITHIN 5 MILES OF AIRPORT
Burnside Township	3	1	33%	0	0%	0	0%
Centre Hall Borough	4	4	100%	0	0%	4	100%
College Township	44	30	68%	6	14%	36	82%
Curtin Township	2	1	50%	1	50%	0	0%
Ferguson Township	27	10	37%	0	0%	16	59%
Gregg Township	10	8	80%	1	10%	10	100%
Haines Township	7	2	29%	0	0%	0	0%
Halfmoon Township	5	1	20%	0	0%	5	100%
Harris Township	8	6	75%	0	0%	0	0%
Howard Borough	4	4	100%	1	25%	0	0%
Howard Township	1	0	0%	0	0%	1	100%
Huston Township	1	1	100%	1	100%	1	100%
Liberty Township	5	3	60%	1	20%	0	0%
Marion Township	3	3	100%	0	0%	0	0%
Miles Township	15	8	53%	0	0%	1	7%
Milesburg Borough	3	3	100%	2	67%	3	100%
Millheim Borough	4	4	100%	0	0%	0	0%
Patton Township	22	16	73%	1	5%	22	100%
Penn Township	15	11	71%	5	33%	7	47%
Philipsburg Borough	9	8	89%	5	56%	0	0%
Port Matilda Borough	4	4	100%	4	100%	4	100%
Potter Township	15	7	47%	1	7%	14	93%
Rush Township	26	11	42%	0	0%	8	31%

Table 4.3.23-5: Critical Facilities Vulnerable to Transportation Accidents

MUNICIPALITY	TOTAL CRITICAL FACILITIES	FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT FACILITIES WITHIN 0.25 MILES OF MAJOR HIGHWAY	FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT FACILITIES WITHIN 0.25 MILES OF ACTIVE RAIL LINE	FACILITIES WITHIN 5 MILES OF AIRPORT	PERCENT FACILITIES WITHIN 5 MILES OF AIRPORT
Snow Shoe Borough	2	2	100%	0	0%	0	0%
Snow Shoe Township	8	4	50%	1	13%	0	0%
Spring Township	19	12	63%	6	32%	14	74%
State College Borough	36	25	69%	0	0%	32	89%
Taylor Township	1	1	100%	0	0%	0	0%
Union Township	5	4	80%	4	80%	5	100%
Unionville Borough	0	0	0%	0	0%	0	0%
Walker Township	13	6	46%	0	0%	8	62%
Worth Township	2	2	100%	1	50%	2	100%
Total	**364**	**228**	**63%**	**56**	**15%**	**230**	**63%**

Table 4.3.23-6: Population Vulnerable to Transportation Accidents

MUNICIPALITY	ESTIMATED 2010 POPULATION	POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	TOTAL POPULATION WITHIN 5 MILES OF AIRPORT	PERCENT POPULATION WITHIN 5 MILES OF AIRPORT
Bellefonte Borough	7,457	7,143	96%	4,548	61%	7,457	100%
Benner Township	1,928	1,928	100%	912	47%	1,928	100%
Boggs Township	1,951	1,792	92%	902	46%	817	42%
Burnside Township	864	864	100%	847	98%	864	100%
Centre Hall Borough	573	569	99%	564	98%	573	100%
College Township	8,126	8,049	99%	3,659	45%	8,126	100%

Table 4.3.23-6: Population Vulnerable to Transportation Accidents

MUNICIPALITY	ESTIMATED 2010 POPULATION	POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	TOTAL POPULATION WITHIN 5 MILES OF AIRPORT	PERCENT POPULATION WITHIN 5 MILES OF AIRPORT
Curtin Township	1,227	1,227	100%	40	3%	91	7%
Ferguson Township	2,482	2,339	94%	855	34%	892	36%
Gregg Township	2,220	2,136	96%	934	42%	0	0%
Haines Township	1,137	1,112	98%	541	48%	182	16%
Halfmoon Township	2,608	2,517	97%	1,186	45%	2,510	96%
Harris Township	24,486	16,025	65%	0	0%	21,120	86%
Howard Borough	46,258	42,860	93%	0	0%	43,861	95%
Howard Township	1,853	1,721	93%	32	2%	0	0%
Huston Township	20,404	20,149	99%	5,771	28%	19,355	95%
Liberty Township	11,607	11,259	97%	6,269	54%	11,607	100%
Marion Township	907	899	99%	725	80%	61	7%
Miles Township	4,539	4,360	96%	2,642	58%	3,541	78%
Milesburg Borough	501	487	97%	0	0%	0	0%
Millheim Borough	1,953	1,942	99%	1,546	79%	1,953	100%
Patton Township	2,356	1,901	81%	576	24%	0	0%
Penn Township	2,558	2,367	93%	0	0%	396	15%
Philipsburg Borough	2,095	2,095	100%	1,788	85%	2,095	100%
Port Matilda Borough	1,128	1,128	100%	268	24%	0	0%
Potter Township	1,640	1,603	98%	912	56%	1,482	90%
Rush Township	3,911	1,721	44%	16	0%	3,857	99%
Snow Shoe Borough	1,177	987	84%	110	9%	117	10%
Snow Shoe Township	2,415	2,368	98%	172	7%	1,473	61%
Spring Township	4,954	4,685	95%	1,851	37%	4,954	100%

Table 4.3.23-6: Population Vulnerable to Transportation Accidents

MUNICIPALITY	ESTIMATED 2010 POPULATION	POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	PERCENT POPULATION WITHIN 0.25 MILES OF MAJOR HIGHWAY	POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	PERCENT POPULATION WITHIN 0.25 MILES OF ACTIVE RAIL LINE	TOTAL POPULATION WITHIN 5 MILES OF AIRPORT	PERCENT POPULATION WITHIN 5 MILES OF AIRPORT
State College Borough	3,433	3,213	94%	1,385	40%	3,424	100%
Taylor Township	19,028	14,116	74%	882	5%	19,028	100%
Union Township	3,691	3,691	100%	1,498	41%	105	3%
Unionville Borough	5,525	5,151	93%	19	0%	4,239	77%
Walker Township	5,029	4,617	92%	1,683	33%	823	16%
Worth Township	5,598	5,586	100%	908	16%	1,141	20%
Total	**207,619**	**184,607**	**89%**	**44,041**	**21%**	**168,072**	**81%**

4.3.24 Urban Fire and Explosion

4.3.24.1 Location and Extent

Urban fire and explosion involves a structure or property fire within an urban or developed area. For hazard mitigation purposes, major urban fires involving large buildings and/or multiple properties are of primary concern. Statewide, this hazard occurs in the denser, more urbanized areas and occurs most often in residential structures (US Fire Administration, 2019). Urban fires can more easily spread from building to building in these denser areas.

Urban fires and explosions can be triggered or exacerbated by other disaster events such as floods, storms, drought, transportation accidents, hazardous materials releases, criminal activity such as arson, and terrorism. Urban fires have the potential to cause extensive damage to residential, commercial, or public property. Damage ranges from minor smoke and/or water damage to the destruction of buildings. People are often displaced for several months to years depending on the magnitude of the event. Urban fires and explosions can also cause injuries and death; in Pennsylvania, the fire mortality rate is approximately 13.9 deaths per million residents, or about 180 fire-related deaths per year. This is the 21st highest fire mortality rate in the nation and is higher than the national average of 13.3 deaths per million residents (US Fire Administration, 2019).

4.3.24.2 Range of Magnitude

The effects of a major urban fire include minor to significant property damage, loss of life, and residential or business displacement. Explosions are extremely rapid releases of energy that usually generate high temperatures and often lead to fires. The risk of severe explosions can be reduced through careful management of flammable and explosive hazardous materials (FEMA, 1997). The impacts of urban fire and explosion events vary based on the size of the incident and the population and structure where it occurs. Although most fires are small structural fires, the cumulative effect of these small incidents can be great in terms of property damage and lives lost. Many small incidents have the potential for a fire disaster if early warning and fire department services are not available. The secondary effects of urban fire events relate to the ability of public, private, and non-profit entities to provide post-incident relief.

There are additional economic consequences related this hazard. Urban fires and explosions may result in lost wages due to temporarily or permanently closed businesses, destruction and damage involving business and personal assets, loss of tax base, recovery costs, and lost investments in destroyed property.

Human services agencies (community support programs, health and medical services, public assistance programs and social services) can be affected by urban fire and explosion events as well. Effects may consist of physical damage to facilities and equipment, disruption of emergency communications, loss of health and medical facilities and supplies, and an overwhelming load of victims who are suffering from the effects of the urban fire, including loss of their home or place of business.

A significant urban fire event occurred in 2005 in Phillipsburg Borough. Fire damaged a total of seven businesses and 30 apartments. This six-alarm blaze involved possible entrapment of residences, fire fighters succumbing to the heat during response, and rescue operations. The fire burned for more than fifteen hours. Five fire fighters were transported to Philipsburg Area Hospital for smoke inhalation and heat exhaustion. All fire fighters were treated and released. One apartment resident suffered smoke inhalation and a second resident suffered burns to the face. The residents were also treated and released at the Philipsburg Area Hospital. A total of 24 fire and four ambulance companies responded to this incident, considered a worst-case scenario for the County.

Figure 4.3.24-1: 2009 Fire at the Cadillac Building in Downtown Bellefonte (The Express, 2009)

Figure 4.3.24-2: Arson Fire at the Hotel Do De in Bellefonte in September 2012 (Centre Daily Times, 2012)

4.3.24.3 Past Occurrence

Centre County experiences at least two major fires annually involving a significant number of the County's fire companies. Some municipalities, such as Bellefonte Borough, have aging housing stock and high-fire load, and experience a major loss fire annually. On December 22, 2009, an overnight blaze damaged the 95-year-old Cadillac Building on the corner of Allegheny and Bishop Streets in historic downtown Bellefonte, displacing the residents of 18 apartments, but injuring no one. An image of this fire is shown in Figure 4.3.24-1. This building became Bellefonte's fifth historic structure burnt by fire in five years. Blazes destroyed The Academy and the Bush House in 2004 and 2006, respectively. Two mansions, Victorian Manor in 2007 and Valentine House in 2008, survived extensive damage. A fire severely damaged another historic structure, the Hotel Do De, on September 9, 2012, shown in Figure 4.3.24-2.

The fire, ruled as arson, damaged the Garman Theater, which is located next to the Hotel Do De. The structure was occupied at the time, but no injuries occurred.

Centre County OES maintains an incident log. While this is not a comprehensive source of all structure fires in Centre County, it provides a listing of incidents that the OES has been involved with between 1989 and January 2021. Table 4.3.24-1 lists 22 structure fires recorder in the incident log, the majority of which occurred in 2002, 2003, and 2018.

Table 4.3.24-1: Structure Fires Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	INCIDENT	LOCATION
5/24/2002	Fire	Structure Fire	126 .S Centre St., Philipsburg Borough
8/10/2002	Fire	Structure Fire	1100 W Aaron Dr, S.C., Ferguson Twp.
11/14/2002	Fire	Structure Fire	Spectrawood, College Twp.
12/4/2002	Fire	House Fire W/ Road Closure	Rte 220, Taylor Twp.
1/4/2003	Fire	House Fire W/ Death	1600 Block Valley View Rd, Benner Twp.
1/15/2003	Fire	PSU Dormitory Fire	Snyder Hall, State College Boro
4/16/2003	Fire	Structure Fire	Mt Nittany Inn, Potter Twp.
8/13/2005	Fire	Structures	Philipsburg Downtown, Philipsburg Borough
2/8/2006	Fire	Bush House	High Street, Bellefonte Borough
4/3/2007	Fire	Structure Fire W/ Firefighter Injury	Victorian Manor, Linn St., Bellefonte Borough
12/22/2009	Fire	Structure Fire	Cadillac Bldg., Bellefonte Borough
9/9/2012	Fire	Structure Fire	Do-De Hotel, 110 E. High Street, Bellefonte Borough
7/4/2013	Fire	Structure Fire	Waupelani Heights, State College Borough
1/12/2018	Fire	Apartment Building Fire - 16 Sheltered	134 E. Foster Ave. State College, State College Borough
1/13/2018	Fire	School Evacuation - HVAC Fire	Marion / Walker Elementary, Walker Township
2/1/2018	Fire	Fire-Smoke - Evacuation	Beaver Hall, State College Borough
10/24/2018	Fire	Apartment Building - Evacuation	The RISE, State College Borough
12/13/2018	Fire	Pine Grove Mills Elementary - Evacuation	Pine Grove Mills, Ferguson Twp.
12/26/2018	Fire	SR 45 Closure	E & L supply, SR 45, Potter Twp.
1/11/2020	Fire	Structure Fire, Tier II Facility	Snow Shoe Refractory, Snow Shoe Twp.
10/5/2020	Fire	Fire in senior high rise – Evacuation	Philipsburg Borough
12/2/2020	Fire	Smoke in senior high rise – Evacuation	Philipsburg Borough
1/19/2021	Fire	Industrial fire at HRI Hanson Quarry	Forrest Avenue, Marion Township

In addition to the OES incident log, Centre County 9-1-1 provided fire reports for 2009-2013 and 2016-2020, which catalog the number of calls the 9-1-1 center received regarding fires. This log is a record of the number of calls related to urban fires, not actual fire incidents. It is possible that a single fire event was reported by multiple callers. These calls were categorized in the reports, and many related to gas and carbon monoxide leaks, training drills, and other non-fire events. Additionally, wildfires and transportation fires were included in these reports. Table 4.3.20-2 displays only calls related to structure or urban fires. The 9-1-1 center received the most calls from State College Borough over the two five-year periods with a total of 1,038 fire-related calls. There was a sharp increase in the total number of calls in Centre County in 2011, and a substantial decrease in number of fire related calls between the two five-year periods. It is possible that the 9-1-1 center has further refined their categorization system.

Table 4.3.24-2: Calls Related to Urban and Structure Fires in Centre County (Centre County 9-1-1, 2020)

Municipality	2009	2010	2011	2012	2013	2016	2017	2018	2019	2020	Total
Bellefonte Borough	33	85	131	78	41	9	9	2	5	0	393
Benner Township	17	32	74	35	33	13	4	4	4	3	219
Boggs Township	10	29	64	28	27	1	5	7	3	1	175
Burnside Township	4	4	13	1	4	0	0	1	1	1	29
Centre Hall Borough	11	15	19	8	5	15	3	2	2	1	81
College Township	50	50	110	49	40	5	2	3	1	0	310
Curtin Township	9	5	17	11	9	0	1	0	4	0	56
Ferguson Township	27	41	94	65	44	9	7	3	4	5	299
Gregg Township	25	13	34	38	48	1	2	4	4	3	172
Haines Township	12	24	39	16	18	1	2	3	3	4	122
Halfmoon Township	32	18	27	9	16	1	1	2	6	3	115
Harris Township	42	38	91	37	36	3	1	0	2	1	251
Howard Borough	1	1	20	6	13	5	0	1	2	0	49
Howard Township	4	28	48	3	6	0	2	2	2	2	97
Huston Township	13	24	44	28	32	1	0	1	1	3	147
Liberty Township	2	3	3	2	1	3	2	3	1	1	21
Marion Township	3	24	50	38	12	1	1	2	2	2	135
Miles Township	20	61	98	60	26	9	15	11	8	7	315
Milesburg Borough	8	3	18	18	12	0	1	1	0	1	62
Millheim Borough	8	10	29	10	21	0	2	0	1	2	83
Patton Township	38	50	94	52	46	0	7	2	2	5	296
Penn Township	2	22	36	23	19	1	1	1	1	3	109
Philipsburg Borough	26	38	80	57	32	4	5	5	2	6	255

Table 4.3.24-2: Calls Related to Urban and Structure Fires in Centre County (Centre County 9-1-1, 2020)

Municipality	2009	2010	2011	2012	2013	2016	2017	2018	2019	2020	Total
Port Matilda Borough	2	19	25	4	15	0	0	2	2	2	71
Potter Township	25	91	158	29	120	1	9	4	6	5	448
Rush Township	19	70	92	13	64	11	9	5	8	3	294
Snow Shoe Borough	4	8	11	2	7	0	2	0	1	3	38
Snow Shoe Township	2	28	54	28	10	5	8	6	9	8	158
Spring Township	33	62	119	41	58	2	11	0	2	1	329
State College Borough	140	161	339	171	168	13	16	9	13	8	1,038
Taylor Township	10	0	0	6	18	0	1	0	0	0	35
Union Township	6	14	35	23	19	0	0	0	0	0	97
Unionville Borough	1	0	0	0	2	0	0	0	0		3
Walker Township	17	33	43	42	30	1	6	7	6	6	191
Worth Township	20	9	18	2	21	2	1	0	1	1	75
Total	**676**	**1,113**	**2,127**	**1,033**	**1,073**	**117**	**136**	**93**	**109**	**91**	**6,568**

4.3.24.4 Future Occurrence

The future occurrence of urban fire and explosion events can be considered *possible*, according to the Risk Factor Methodology (see Table 4.4-1), with minor events happening more frequently than major fires or explosions in the future. The greatest urban fire and explosion threats in Centre County are industrial fires and hazardous materials fires. While residential fires are more common, industrial fires have a potentially higher risk because of the possibility of there being flammable chemicals and a sustained fuel source at industrial sites. Areas with greater population density are also at a greater risk for fires.

4.3.24.5 Vulnerability Assessment

Areas where large buildings are located or where development is closely spaced are more vulnerable to urban fire and explosion events. In Centre County, the jurisdictions with the highest population densities (greater than 5,000 persons per square mile) include State College and Bellefonte Boroughs. In order to adequately assess vulnerability to urban fires and explosions, detailed information on the design specifications, specifically fire codes, used for the construction of individual buildings is required.

As of December 31, 2006, all communities in Pennsylvania are required to comply with the Uniform Construction Codes. This includes requirements to comply with both the International Fire Code and the International Wildland Urban Interface Code. The adoption and enforcement of these codes will likely decrease the overall vulnerability of structures in Centre County. However, these regulations will only affect new construction, as well as additions and renovations to existing structures. Older buildings that do not meet the criteria established in these modern fire codes will continue to remain vulnerable to urban fire and explosion events.

4.3.25 Utility Interruption

4.3.25.1 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 in fuel, energy, or utility failure.

These kinds of interruptions rarely spontaneously occur on their own; this hazard is often secondary to other natural hazard events, particularly transportation accidents, lightning strikes, extreme heat or cold events, and coastal and winter storms. For example, severe thunderstorms or winter storms could bring down power lines and cause widespread disruptions in electricity service. Strong heat waves may result in rolling blackouts where power may not be available for an extended period. Local outages may be caused by traffic accidents or wind damage.

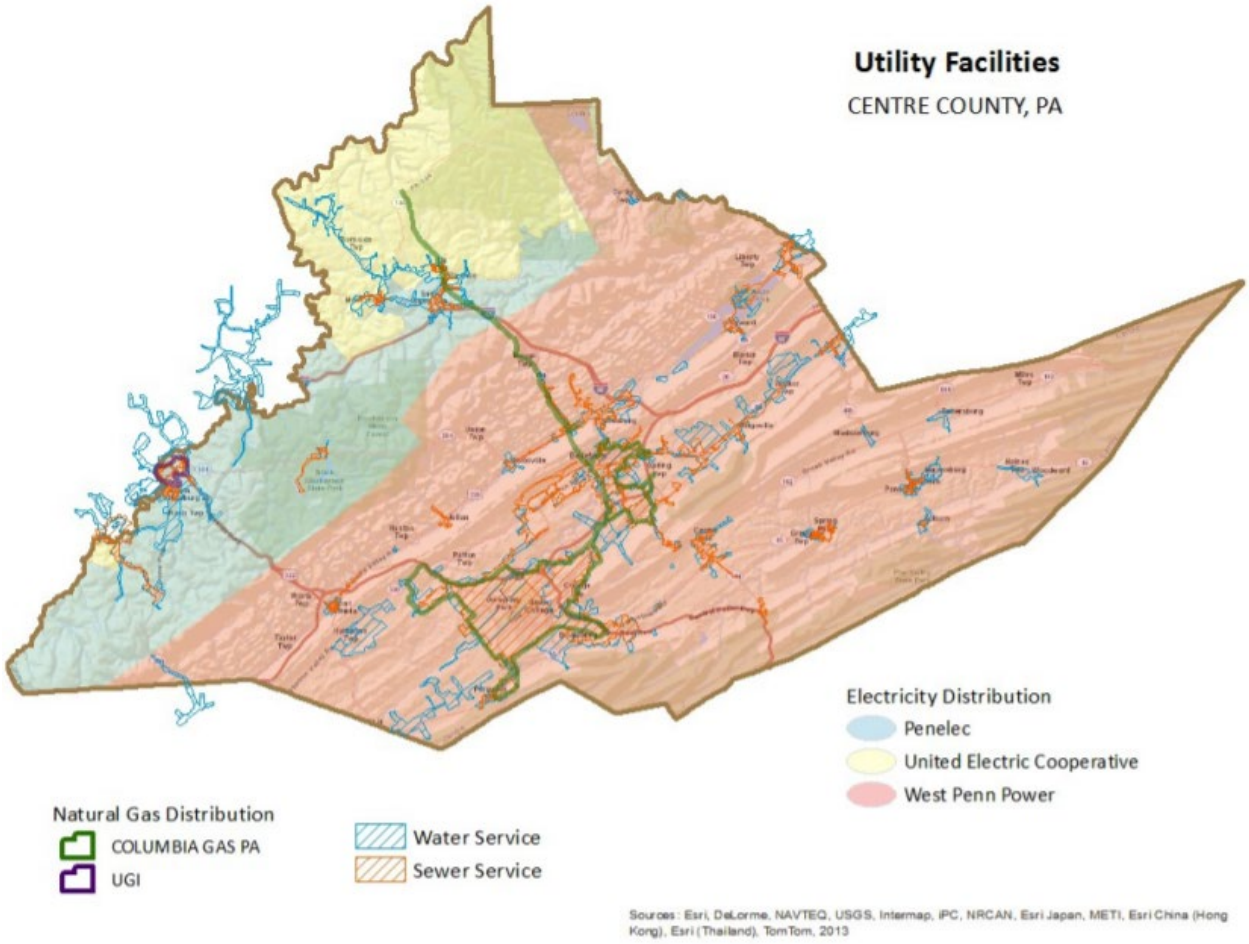
Utility interruptions and power failures can take place throughout the County. Centre County was previously served by Allegheny Power; however, this electric utility provider merged with FirstEnergy Corp. in 2011. First Energy Corp. consists of ten electric utility companies that served 6 million customers in Ohio, Pennsylvania, West Virginia, New Jersey, Maryland, and New York. Centre County's utility provider under First Energy Corp. is West Penn Power (FirstEnergy, 2020).

According to the 2018 5-year American Community Survey, in Allegheny County, 41.2% of housing units use electric heat, followed by 23.3% of homes using utility gas as their heat source (U.S. Census Bureau, 2018). As a result, an interruption in either of those utilities could affect a significant number of residents. Natural gas expansion continues to be at the forefront of infrastructure planning through the SEDA-COG Natural Gas Cooperative, of which Centre County is a member. Targeted areas for installing new natural gas pipeline include Centre Hall Borough, the industrial corridor in Boggs Township, and the Interstate 80 interchange for Snow Shoe (CCPCDO, 2019a). In addition, an increasing reliance on internet access and telecommunications could also impact a large number of residents at any given time.

There are 47 public/community water systems and 24 public/community sewer systems in Centre County. Nearly all of these systems are operated as an authority. Only a handful of systems provide water and sewerage to multiple municipalities or are operated in-join by multiple municipalities (CCPCDO, 2019a).

Figure 4.3.25-1 identifies utility facilities and services throughout Centre County. As information becomes more readily available for future Plan Updates, fiber optic lines and broadband data will also be considered as part of the utility facilities map.

Figure 4.3.25-1: Utility Facilities and Service Areas in Centre County (CCPCDO, 2019a)



4.3.25.2 Range of Magnitude

Most severe power failures or outages are regional events. With the loss of power, electric-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. These issues

are often more of a nuisance than a hazard but can cause damage or harm depending on the population affected and the severity of the outage.

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 process payments and invoices electronically rather than with physical checks

In a possible worst-case scenario in Centre County, a winter storm event could cause widespread power outages, leaving citizens without heat in the midst of subzero temperatures for several days. The power outage would also put elderly populations or others at risk of health problems due to the lack of heat and the inability to call for assistance or leave their homes. Power lines may also be difficult to repair because of the magnitude of the storm.

4.3.25.3 Past Occurrence

Energy emergencies may be caused by nationwide shortages or localized supply problems. Centre County, like most of Pennsylvania, experienced problems in 1972-73 and again in 1976-77. During the 1972-73 incident, the County was particularly affected by heating oil shortages. Voluntary cutbacks in energy use helped ease the shortage. In 1976-77, the main problem was a gasoline shortage. This time voluntary cutbacks were insufficient, and an odd-even rationing plan was enforced. The County Emergency Management Agency designated fuel distributions for emergency and priority users.

In October 2009, it was estimated that 12,000 residents in Centre County were without power as falling trees and tree limbs caused as many as 350 separate "outages" during a snowstorm. Snow and wind events that can inflict severe tree damage have caused power disruptions in the past and minor power outages are anticipated to occur annually.

Centre County has experienced several occurrences of utility interruption in the past. Centre County OES maintains an incident log, which contains 20 events related to utility interruptions. Fourteen of these events were related to power outages, while the others were related to other utilities, primarily water outages. This log has been maintained from January 1989 to present (January 2021), with all utility emergencies activity occurring between 1990 and 2020. While this is not a comprehensive source of all incidents in Centre County, it provides an inventory of events that the OES has been involved with. As shown in Table 4.3.25-1, several power outages were countywide, such as the event caused by wet snowfall in 2002, while others were isolated to sections of a single municipality.

Table 4.3.25-1: Utility Emergencies Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	DESCRIPTION	LOCATION
6/14/1990	Power Outage	-	Sections of Bellefonte

Table 4.3.25-1: Utility Emergencies Recorded in Centre County OES Incident Log (Centre County EMA, 2021)

DATE	TYPE	DESCRIPTION	LOCATION
11/15/1995	Power Outage	-	County Wide
6/4/2002	Power Outages	Outages due to severe thunderstorms	N. Atherton, Patton Twp.
10/30/2002	Power Outages	Outages due to wet snowfall	County-Wide
3/2/2011	Power Outage	-	Lemont, Waupelani Dr.,
3/6/2011	Power Outage	-	Countywide
5/23/2015	Power Outages	Outages due to severe thunderstorms that downed utility poles and a transformer	Walker Township
4/21/2017	Power Outages	Outages due to high winds up to 110 mph. Over 16,000 customers impacted, some for over 3 days	Countywide
6/1/2017	Power Outage	Over 6,300 customers impacted due to severe weather	Patton, Worth, and Taylor Townships
1/3/2018	Water Outage	Water main breaks, outage, boil advisory	Snow Shoe and Burnside Townships
1/13/2018	Water Outage	Additional water main breaks	Snow Shoe and Burnside Townships
1/16/2018	Water Outage	Water main breaks, outage, boil advisory	Unionville Borough
1/18/2018	Water Outage	Water main breaks, outage, boil advisory	Mt. Top Water
1/19/2018	Water Outage	Water main breaks, outage, boil advisory	Bellefonte Borough
3/29/2018	Power Outages	Various outages across the county due to high winds and severe weather	Countywide
1/14/2019	Water Advisory	Advisory to boil water before use at Martha Furnace MHP	Huston Township
2/13/2019	Power Outages	Outages due to high winds	Countywide
10/28/2019	Power Outages	Over 2,500 customers impacted due to severe weather	Countywide
4/17/2020	Power Outages	2,000 customers impacted, warming shelters needed	Countywide
5/6/2020	Power Outage	Transformer fire caused outages for 5,500 customers	College Township, Ferguson Township

4.3.25.4 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).

The State College region 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 probability of utility interruptions can be considered *likely* according to the Risk Factor Methodology (See Table 4.4-1).

Aging infrastructure also brings risk in the form of potential utility interruptions, particularly for places like Centre County with aging infrastructure. In many utility systems, significant portions of the 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 service. 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; repair, not replacement is generally the choice 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.

4.3.25.5 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, wind storms, tornado, flooding, and other natural hazard events may be more vulnerable to a utility interruption.

Emergency medical facilities, including 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 elderly populations are particularly vulnerable. Appendix D provides a list of where those facilities are located in Centre County. Conservation and improved technology have resulted in more efficient use of energy sources. The increasing use of alternative fuel supplies, such as kerosene heaters, wood burning stoves, coal burners, etc., has also decreased our vulnerability to future shortages. However, severe weather extremes, accidents, labor strikes, terrorism, or nationwide shortages could cause significant energy shortage problems.

4.4 HAZARD VULNERABILITY SUMMARY

4.4.1 Methodology

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

RF values were obtained by assigning varying degrees of risk to five categories for each of the hazards profiled in the HMP Update. Those categories include *probability, impact, spatial extent, warning time, and duration*. Each degree of risk was assigned a value ranging from one to four. 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 following 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

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% and 49.9% annual probability		2	
	Likely	Between 50% and 90% annual probability		3	
	Highly Likely	Greater than 90% annual probability		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 and 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 and 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 and 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% and 10.9% of area affected		2	
	Moderate	Between 11% and 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?*	> 24 hours	Self-defined	*Note: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.*	1	10%
	12 to 24 hours	Self-defined		2	
	6 to 12 hours	Self-defined		3	
	< 6 hours	Self-defined		4	
Duration *How long does the hazard event usually last?*	< 6 hours	Self-defined	*Note: Levels of duration time and criteria that define them may be adjusted based on hazard addressed.*	1	10%
	< 24 hours	Self-defined		2	
	< 1 week	Self-defined		3	
	> 1 week	Self-defined		4	

4.4.2 Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4-2 lists the Countywide RF calculated for each of the 25 potential hazards identified in the 2021 HMP Update. Hazards identified as *high* risk have risk factors greater than 2.5. Risk Factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with Risk Factors 1.9 and less are considered *low* risk. Based on these results, Centre County has four high risk hazards, nine moderate risk hazards, and 12 low risk hazards for a total of 25 hazards.

Table 4.4-2: Ranking of Hazard Types Based on Risk Factor Methodology

RISK	HAZARD NATURAL (N) OR MAN-MADE (M)	RISK ASSESSMENT CATEGORY					RF
		PROBABILITY	IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Winter Storm (N)	4	2	4	1	3	3.0
	Flood, Flash Flood, Ice Jam (N)	3	3	3	3	3	3.0
	Pandemic and Infectious Disease (N)	2	3	3	1	4	2.6
	Drought (N)	2	2	4	1	4	2.5
MODERATE	Tornado, Windstorm (N)	2	3	2	4	1	2.4
	Environmental Hazards (EH) - Hazardous Materials Release (M)	2	2	2	4	3	2.3
	Opioid Addiction (M)	4	2	1	2	1	2.3
	Hurricane, Tropical Storm, Nor'easter (N)	2	2	3	1	3	2.2
	Terrorism (M)	1	3	2	4	2	2.2
	Utility Interruption (M)	3	1	2	3	2	2.1
	Subsidence, Sinkhole (N)	3	2	1	2	2	2.1
	EH - Conventional Oil and Gas Wells (M)	2	2	1	4	3	2.1
	EH - Unconventional Oil and Gas (M)	2	2	1	4	3	2.1
LOW	Transportation Accidents (M)	3	1	1	4	1	1.9
	Dam Failure (M)	1	2	2	4	2	1.9
	Wildfire (N)	2	1	1	4	2	1.7
	Cyber Terrorism (M)	2	1	1	4	2	1.7
	Nuclear Incidents (M)	1	1	1	4	4	1.6
	Civil Disturbance (M)	2	1	1	4	1	1.6
	Landslide (N)	2	1	1	4	1	1.6
	Earthquake (N)	1	1	2	4	1	1.5
	Radon Exposure (N)	2	1	1	2	2	1.5
	Extreme Temperature (N)	1	2	1	1	2	1.4
	Urban Fire and Explosion (M)	2	1	1	1	2	1.4
	Lightning Strike (N)	1	1	1	4	1	1.3

Hazard Risk Factors and rankings have remained generally consistent with those identified in the 2015 Plan Update, with a few notable updates. With the recent ongoing and widespread global pandemic, the full impact of which is still unknown, Pandemic and Infectious Disease has an increased Risk Factor and has moved from a medium risk to a high risk hazard. Additionally, given the magnitude of recent flood events and a reported increase in the frequency, impact, and extent of these events from participating jurisdictions, the Risk Factor for Flood, Flash Flood, Ice Jam increased and now shares the top high risk ranking with Winter Storm.

With the separation of Environmental Hazards into three distinct hazard profiles, the probably of each specific Environmental Hazard was reevaluated in terms of probability and spatial extent. All three of these Environmental Hazards – Hazardous Materials Release, Conventional Oil and Gas Wells, Unconventional Oil and Gas Wells – are now included as medium-risk hazards.

Finally, the newly identified Opioid Addiction hazard is identified as medium risk, largely due to the high probability that such an event will occur. The newly identified Cyber Terrorism profile is ranked as a lower risk hazard.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. Table 4.4-3 shows the different municipalities in Centre 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: Jurisdictional Risk Evaluation

MUNICIPALITY	Winter Storm (N)	Flood, Flash Flood, Ice Jam (N)	Pandemic and Infectious Disease (N)	Drought (N)	Tornado, Windstorm (N)	EH - Hazardous Materials Release (M)	Opioid Addiction (M)	Hurricane, Tropical Storm, Noreaster (N)	Terrorism (M)	Utility Interruption (M)	Subsidence, Sinkhole (N)	EH - Conventional Oil & Gas Wells (M)	EH - Unconventional Oil & Gas (M)	Transportation Accidents (M)	Dam Failure (M)	Wildfire (N)	Cyber-Terrorism (M)	Nuclear Incidents (M)	Civil Disturbance (M)	Landslide (N)	Earthquakes (N)	Radon Exposure (N)	Extreme Temperatures (N)	Urban Fire and Explosion (M)	Lightning Strike (N)
Bellefonte Borough	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=
Benner Township	=	=	=	=	=	=	=	=	>	=	>	=	=	>	>	=	=	=	>	>	=	=	=	=	=
Boggs Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Burnside Township	=	=	=	=	=	=	=	>	=	=	<	>	>	>	<	>	=	=	=	=	=	=	>	=	>
Centre Hall Borough	=	<	<	<	=	<	=	<	<	<	=	<	<	=	<	<	=	<	=	<	=	=	=	=	=
College Township	=	=	=	=	=	>	=	=	>	=	>	=	=	>	<	=	>	>	>	=	=	=	=	>	=
Curtin Township	=	=	=	=	>	>	>	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Ferguson Township	=	=	=	>	=	=	=	=	=	>	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=
Gregg Township	=	=	=	=	=	=	=	=	=	=	=	<	<	<	>	=	<	<	<	<	=	=	=	=	=
Haines Township	=	<	=	>	=	=	=	=	<	=	>	<	<	=	>	>	=	<	<	=	=	<	=	<	=
Halfmoon Township	=	=	=	=	=	<	<	=	<	>	=	<	<	<	<	=	>	=	=	=	=	=	=	=	=
Harris Township	=	<	>	=	>	=	=	=	=	>	=	<	<	>	<	>	=	<	=	<	<	=	=	<	=
Howard Borough	=	=	=	=	=	=	=	=	=	=	=	<	<	=	=	=	=	=	=	=	=	=	=	=	=

Table 4.4-3: Jurisdictional Risk Evaluation

MUNICIPALITY	Winter Storm (N)	Flood, Flash Flood, Ice Jam (N)	Pandemic and Infectious Disease (N)	Drought (N)	Tornado, Windstorm (N)	EH - Hazardous Materials Release (M)	Opioid Addiction (M)	Hurricane, Tropical Storm, Noreaster (N)	Terrorism (M)	Utility Interruption (M)	Subsidence, Sinkhole (N)	EH - Conventional Oil & Gas Wells (M)	EH - Unconventional Oil & Gas (M)	Transportation Accidents (M)	Dam Failure (M)	Wildfire (N)	Cyber-Terrorism (M)	Nuclear Incidents (M)	Civil Disturbance (M)	Landslide (N)	Earthquakes (N)	Radon Exposure (N)	Extreme Temperatures (N)	Urban Fire and Explosion (M)	Lightning Strike (N)
Howard Township	=	=	=	=	=	<	=	=	<	=	<	=	=	=	=	>	=	=	<	=	=	=	=	<	=
Huston Township	=	=	=	=	=	=	=	=	=	=	<	<	<	=	>	=	=	=	=	=	=	=	=	=	=
Liberty Township	=	>	=	=	=	>	=	=	=	=	=	>	>	>	>	=	=	=	=	>	=	>	=	=	=
Marion Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Miles Township	=	=	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Milesburg Borough	=	>	=	=	=	=	=	=	=	=	=	<	<	=	=	<	=	=	=	=	=	=	=	=	=
Millheim Borough	=	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=
Patton Township	=	<	>	=	=	=	>	=	=	>	>	<	<	>	<	=	=	=	>	=	=	=	=	>	>
Penn Township	>	>	<	=	=	>	<	=	=	>	>	<	<	=	>	=	=	=	=	=	=	>	=	=	=
Philipsburg Borough	<	<	=	=	<	>	=	>	=	=	>	>	>	>	=	>	=	<	>	<	<	=	=	>	=
Port Matilda Borough	=	>	=	=	=	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	=
Potter Township	=	=	>	=	>	=	=	>	=	=	>	=	=	=	<	=	=	=	=	=	>	>	=	=	>
Rush Township	=	>	=	<	=	>	=	=	=	=	=	>	>	>	>	>	=	=	=	>	=	=	=	=	=

Table 4.4-3: Jurisdictional Risk Evaluation

MUNICIPALITY	Winter Storm (N)	Flood, Flash Flood, Ice Jam (N)	Pandemic and Infectious Disease (N)	Drought (N)	Tornado, Windstorm (N)	EH - Hazardous Materials Release (M)	Opioid Addiction (M)	Hurricane, Tropical Storm, Noreaster (N)	Terrorism (M)	Utility Interruption (M)	Subsidence, Sinkhole (N)	EH - Conventional Oil & Gas Wells (M)	EH - Unconventional Oil & Gas (M)	Transportation Accidents (M)	Dam Failure (M)	Wildfire (N)	Cyber-Terrorism (M)	Nuclear Incidents (M)	Civil Disturbance (M)	Landslide (N)	Earthquakes (N)	Radon Exposure (N)	Extreme Temperatures (N)	Urban Fire and Explosion (M)	Lightning Strike (N)
Snow Shoe Borough	=	<	=	=	=	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Snow Shoe Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=
Spring Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	<	<	=	=	=	=	=
State College Borough	=	<	>	=	=	=	=	=	>	>	>	<	<	<	<	<	>	=	>	=	=	>	=	>	=
Taylor Township	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=	=	=	>	=	=	=	=	=
Union Township	=	=	=	=	=	=	=	=	<	=	=	<	<	=	<	=	<	<	<	=	=	=	=	<	=
Unionville Borough	=	>	=	=	=	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	=
Walker Township	=	>	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	>	=	=	=
Worth Township	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=	>	=	=	=	>	=	=	=	=	=
Penn State University	=	<	>	=	=	=	=	=	=	=	=	<	<	=	=	=	>	=	>	=	=	=	=	=	=

This table was developed based on the Risk Assessment findings and municipal input from the "Evaluation of Identified Hazards and Risk" and "Jurisdictional Hazard Risk Ranking" forms distributed to each municipality. Those changes are reflected in the table.

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 NCEI storm events database, the NFIP, and the USDA's Risk Management Agency (RMA) 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 sections of hazard profiles for floods, landslides, subsidence, wildfires, dam failure, environmental hazards, and transportation accidents. Finally, predictive losses were generated using Hazus-MH, version 2.1. Historical losses do not consider any of the aforementioned components, but they do provide insight into what future losses might be. The current-condition losses consider replacement value and exposure value. Hazus modeling considers all four components and provides the most comprehensive description of potential losses.

4.4.3.1 Historic Losses

Historical losses were determined for drought, flooding, coastal storms (hurricanes/tropical storms/nor'easters), tornadoes/windstorms, lightning strike, and winter storms from NCEI, USDA RMA, and the NFIP. NCEI reports include property and crop damage estimates with their incident reports. However, as noted in the hazard profiles, many of the events have no damages reported. This does not mean that there were no damages; rather, it indicates that no damages were reported to NCEI. As a result, these should be considered low-end estimates of losses. The flood and flash flood events reported in NCEI list more than $6.7 million in property damage since 1993. Since 1996, there have been over $1 million in damages reported to NCEI due to winter storms, although in most events, damages were not provided. Since 1962, windstorm and tornado events resulted in more than $1.7 million in property damages and

three injuries reported to NCEI. There were two reported injuries, and no property damages, from a lightning event listed in NCEI. There were no damages, deaths, or casualties reported for extreme temperature or coastal storm events in the NCEI database.

Agriculture is a vital part of Centre County's economy, and agricultural production is highly vulnerable to natural hazards. Losses are available from the RMA, which operates and manages the Federal Crop Insurance Corporation providing crop insurance to American farmers. While not all crops are insured through RMA, their records provide strong insight into agricultural losses. Table 4.4-4 illustrates the total amount of indemnities paid through RMA since 1989 in Centre County by type of crop failure. Only crop failures related to the hazards discussed in this plan are listed. There has been $6.4 million in indemnity paid out due to crop loss between 1948 and 2019 in Centre County. The greatest amount of indemnity paid out was due to crop loss from drought, which accounts for 58.7 percent of the loss.

Table 4.4-4: Historic Insured Crop Losses, 1989-2019 (USDA RMA, 2020)

REASON FOR LOSS	INDEMNITY AMOUNT
Cold Wet Weather	$201,114.60
Drought	$3,758,507.70
Excess Moisture/Precipitation/Rain	$1,139,870.10
Flood	$4,322.00
Cold Winter or Freeze or Frost	$38,589.00
Heat	$22,021.00
Hurricane/Tropical Depression	$1,066.00
Tornado	$1,486.00
Wind/Excess Wind	$31,417.00
Other	$1,204,754.80
Total	**$6,403,148.20**

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 FEMA's Community Information System (CIS). A total of $3.16 million has been paid to municipalities in the County, $1 million of which was paid to 18 claims in Bellefonte.

Table 4.4-5: Centre County NFIP Claims Information (FEMA CIS, 2020b; FEMA CIS, 2020c)

COMMUNITY	PRIOR CLAIMS	TOTAL AMOUNGT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Bellefonte Borough	18	$1,020,685	1
Benner Township	6	$8,814	0
Boggs Township	20	$49,671	0
Burnside Township	5	$11,035	0
Centre Hall Borough	2	$0	0
College Township	32	$378,208	2
Curtin Township	2	$13,698	0

Table 4.4-5: Centre County NFIP Claims Information (FEMA CIS, 2020b; FEMA CIS, 2020c)

COMMUNITY	PRIOR CLAIMS	TOTAL AMOUNGT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Ferguson Township	9	$43,787	0
Gregg Township	19	$82,510	0
Haines Township	11	$4,497	0
Halfmoon Township	0	$0	0
Harris Township	8	$9,108	0
Howard Borough	0	$0	0
Howard Township	0	$0	0
Huston Township	2	$0	0
Liberty Township	11	$41,549	0
Marion Township	0	$0	0
Miles Township	59	$528,285	0
Milesburg Borough	10	$84,330	4
Millheim Borough	5	$18,856	2
Patton Township	46	$244,684	0
Penn Township	21	$31,889	3
Philipsburg Borough	2	$4,339	0
Port Matilda Borough	8	$25,626	0
Potter Township	27	$196,324	0
Rush Township*	2	$2,427	1
Snow Shoe Borough	0	$0	0
Snow Shoe Township	3	$1,421	0
Spring Township	18	$96,268	0
State College Borough	5	$221,141	1
Taylor Township	0	$0	0
Union Township	3	$25,780	0
Unionville Borough	5	$7,091	0
Walker Township	7	$9,877	0
Worth Township	0	$0	0
Total	366	$3,161,900	14

**The CIS database provided separate totals for South Philipsburg Borough and Rush Township. As the South Philipsburg Borough has been annexed by Rush Township, information presented in the table above for Rush Township includes information for the area formerly incorporated as South Philipsburg Borough.*

4.4.3.2 Current Condition Losses

The current condition losses were derived using the total assessed value, including land and building values, from the Centre County Tax Assessment Database. Table 4.4-8 details the total assessed values by municipality and type of land. Please note, the data received from Centre County attributed values for buildings and land by parcels. If there was more than one structure on one parcel, then the values would be increased by the number of structures on the parcel; this may inflate the total assessed value, though this was not a common occurrence.

Table 4.4.3-6: Total Assessed Value by Land Use and Municipality

MUNICIPALITY	LAND USE									
	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OPEN AND VACANT LAND	RESIDENTIAL	UTILITY	WELLS AND MINE	OTHER	TOTAL
Bellefonte Borough	-	$9,670,590	$12,255	$2,082,050	$8,984,025	$193,102,170	$363,955	-	$110,277,555	$324,492,600
Benner Township	$82,377,290	$61,602,675	$8,522,115	$11,236,760	$45,665,375	$661,598,070	$83,972,365	$776,630	$660,640,455	$1,616,391,735
Boggs Township	$1,021,085	$16,911,800	$588,795	$10,422,190	-	$90,102,955	$383,435	$11,520	$92,440,870	$211,882,650
Burnside Township	$95,980	$262,820	$13,610,890	-	$179,595	$269,538,005	$91,155	$25,342,470	$2,419,675	$311,540,590
Centre Hall Borough	-	$958,525	-	$240,170	$226,275	$22,348,495	-	-	$23,157,510	$46,930,975
College Township	$1,569,077,175	$291,178,915	$259,535,490	$47,524,025	$214,071,755	$1,753,591,760	$108,925,950	$420,390	$11,292,358,325	$15,536,683,785
Curtin Township	$379,890	$46,735	$4,702,710	-	$304,650	$31,310,350	$8,481,570	$980,290	$965,325	$47,171,520
Ferguson Township	$116,001,050	$208,150,890	$10,164,230	$52,323,225	$15,016,370	$3,507,243,450	$867,160	-	$58,970,435	$3,968,736,810
Gregg Township	$2,189,975	$3,820,430	$1,582,115	$142,955	$1,776,300	$48,424,620	$98,750	-	$8,054,975	$66,090,120
Haines Township	$1,766,520	$45,349,635	$45,152,300	$13,140	$3,064,220	$90,505,540	$39,625	$194,960	$119,969,250	$306,055,190
Halfmoon Township	$2,688,995	$1,436,970	$2,409,120	-	$4,408,895	$72,849,695	$787,470	-	$1,618,515	$86,199,660
Harris Township	$7,497,570	$12,222,075	$21,616,060	$4,549,740	$25,791,270	$282,686,825	$2,055,460	-	$33,717,450	$390,136,450
Howard Borough	$217,550	$171,460	-	-	$205,575	$9,818,170	$-	-	$4,790,895	$15,203,650

Table 4.4.3-6: Total Assessed Value by Land Use and Municipality

MUNICIPALITY	LAND USE									
	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OPEN AND VACANT LAND	RESIDENTIAL	UTILITY	WELLS AND MINE	OTHER	TOTAL
Howard Township	$2,521,165	$743,830	$22,816,695	-	$28,835	$14,501,875	$5,719,920	-	$193,476,935	$239,809,255
Huston Township	$86,735	$3,634,620	$13,435,860	$14,280	$298,070	$23,303,490	$-	-	$1,806,935	$42,579,990
Liberty Township	$711,475	$581,830	$7,613,915	-	$590,630	$26,411,545	$7,109,640	-	$172,272,255	$215,291,290
Marion Township	$1,005,335	$1,518,355	$1,105,765	$253,850	$301,605	$22,033,670	$19,315	$692,960	$983,685	$27,914,540
Miles Township	$2,137,280	$1,393,155	$13,396,985	$813,430	$1,914,035	$110,029,985	$31,865	-	$10,916,260	$140,632,995
Milesburg Borough	-	$1,586,710	-	-	$77,385	$14,398,615	$91,450	-	$1,636,115	$17,790,275
Millheim Borough	$62,975	$885,670	-	$22,620	$533,335	$12,850,585	$53,915	-	$2,611,345	$17,020,445
Patton Township	$15,940,965	$146,707,320	$1,865,736,395	$10,146,110	$13,907,305	$2,344,129,380	$442,880	-	$168,670,970	$4,565,681,325
Penn Township	$1,209,270	$2,765,580	$5,244,015	-	$95,095	$28,621,020	$6,985,765	-	$100,381,610	$145,302,355
Philipsburg Borough	-	$4,681,300	$4,831,705	$81,650	$729,150	$30,228,640	$285,465	-	$26,118,190	$66,956,100
Port Matilda Borough	-	$688,745	$26,625	-	$73,510	$5,809,305	$497,660	-	$3,222,080	$10,317,925
Potter Township	$3,685,480	$30,248,560	$4,138,540	$384,840	$4,244,900	$131,360,570	$1,892,015	$356,510	$23,960,425	$200,271,840
Rush Township	$189,565	$20,626,090	$67,464,820	$1,832,490	$8,928,470	$1,046,705,710	$23,899,950	$16,044,015	$912,278,710	$2,097,969,820

Table 4.4.3-6: Total Assessed Value by Land Use and Municipality

MUNICIPALITY	LAND USE									
	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OPEN AND VACANT LAND	RESIDENTIAL	UTILITY	WELLS AND MINE	OTHER	TOTAL
Snow Shoe Borough	-	$295,190	-	-	$104,745	$9,036,235	$17,500	-	$2,933,930	$12,387,600
Snow Shoe Township	$510,280	$4,044,750	$4,125,605	$2,024,145	$575,480	$68,597,230	$183,465	$9,760,440	$4,814,325	$94,635,720
Spring Township	$2,123,325	$37,180,915	$2,425,740	$21,852,825	$46,783,050	$215,191,105	$6,627,695	$9,451,790	$66,207,440	$407,843,885
State College Borough	-	$260,598,795	$51,165,390	$50,103,970	$23,767,525	$12,342,855,900	$277,882,480	-	$9,256,476,645	$22,262,850,705
Taylor Township	$120,260	$8,364,985	$1,814,760	$93,015	$184,265	$16,746,690	$2,310,330	-	$695,565	$30,541,755
Union Township	$401,560	$2,777,160	$358,750	-	$525,605	$26,287,700	$133,300	-	$89,883,180	$120,367,255
Unionville Borough	-	$22,410	$75,565	-	$54,395	$3,470,625	-	-	$320,320	$3,943,315
Walker Township	$1,982,295	$4,608,470	$3,185,355	$264,595	$2,865,465	$98,718,870	$683,945	-	$6,334,885	$118,643,880
Worth Township	$118,795	$720,115	$575,110	$110,225	$87,535	$15,387,870	$103,850	-	$1,814,010	$18,917,510
Total	**$1,816,119,840**	**$1,186,458,075**	**$2,437,433,675**	**$216,532,300**	**$426,364,695**	**$23,641,545,955**	**$541,039,300**	**$64,031,975**	**$23,457,197,050**	**$53,787,408,350**

4.4.3.3 Predictive Losses

This 2021 Plan Update 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 include:

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

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

Using these datasets in Hazus-MH Version 2.1, total economic losses from a 1-percent-annual-chance flood in Centre County are estimated at $198.82 million, nearly all of which is attributed to building loss. Residential occupancies make up 48.2 percent of the total estimated building-related losses, and commercial buildings make up a further 31.2 percent of the losses. According to the model, two fire stations and one school would suffer moderate damage.

Figure 4.4-2 shows the distribution of building-related losses by census block across Centre County. The areas with the highest potential losses are concentrated in the southern and central parts of Centre County, particularly along Spring Creek in College and Spring Townships as well near Foster Joseph Sayers Lake in Howard Borough, Howard Township, and Liberty Township. The full HAZUS results report can be found in Appendix F.

Figure 4.4-1: Economic Loss Estimates ($M) by Occupancy Type for Centre County as Calculated by Hazus

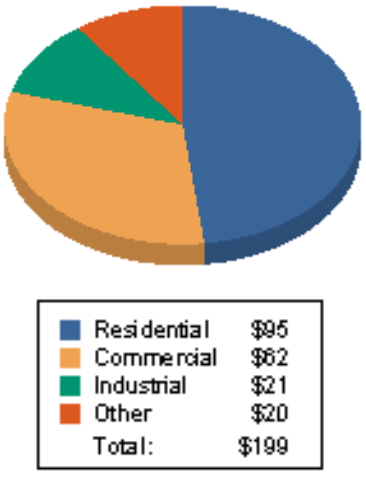
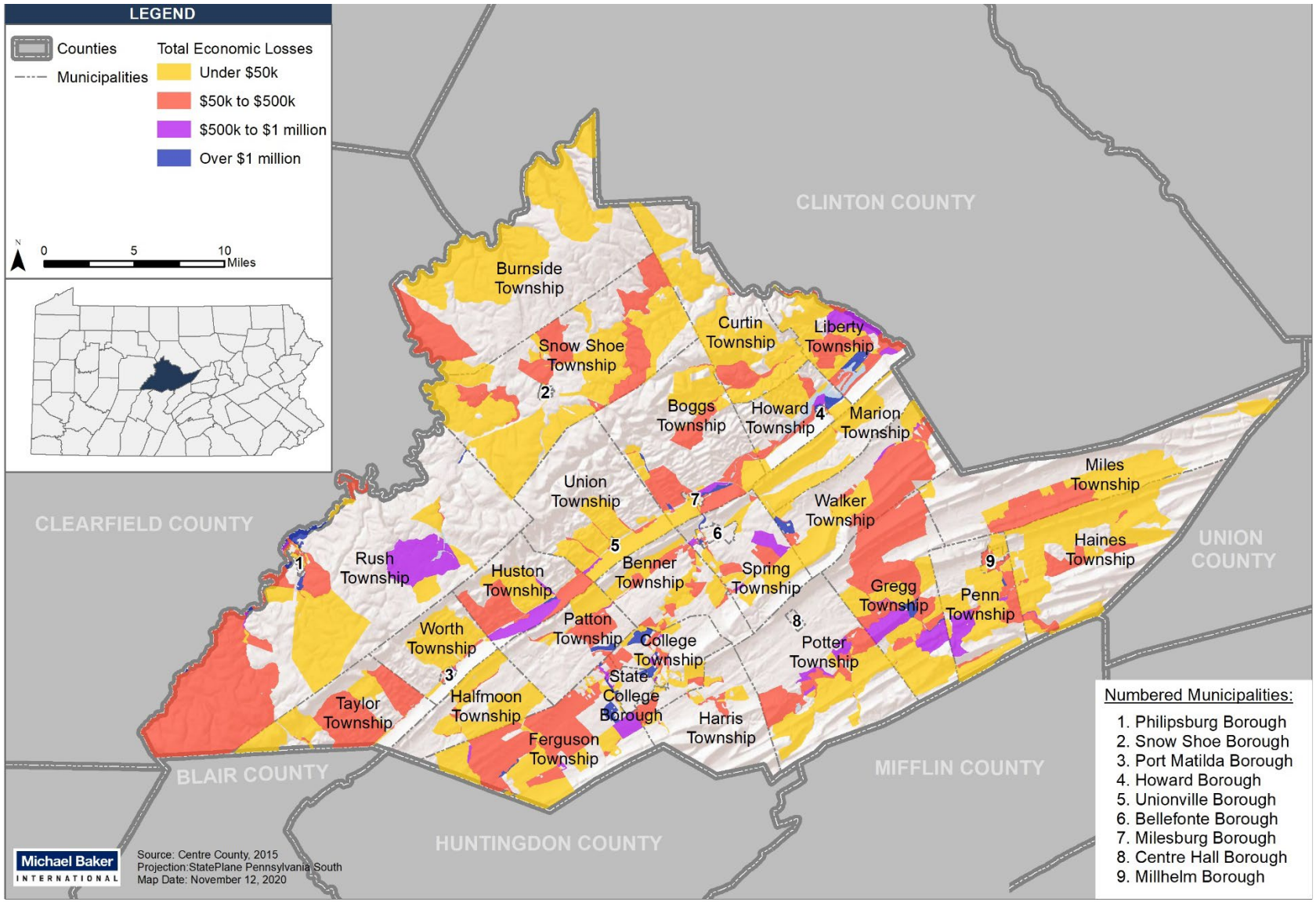


Figure 4.4-2: Centre County Potential Loss Calculated with Hazus



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.

Population change is perhaps the most significant indicator of future changes in vulnerability. As discussed in Section 2.3, the total population in Centre County is estimated to have increased by approximately five percent, between the 2010 and 2018 (see Table 2.3-1). However, this increase is not equally distributed across the County. Populations increased in some municipalities but declined in others.

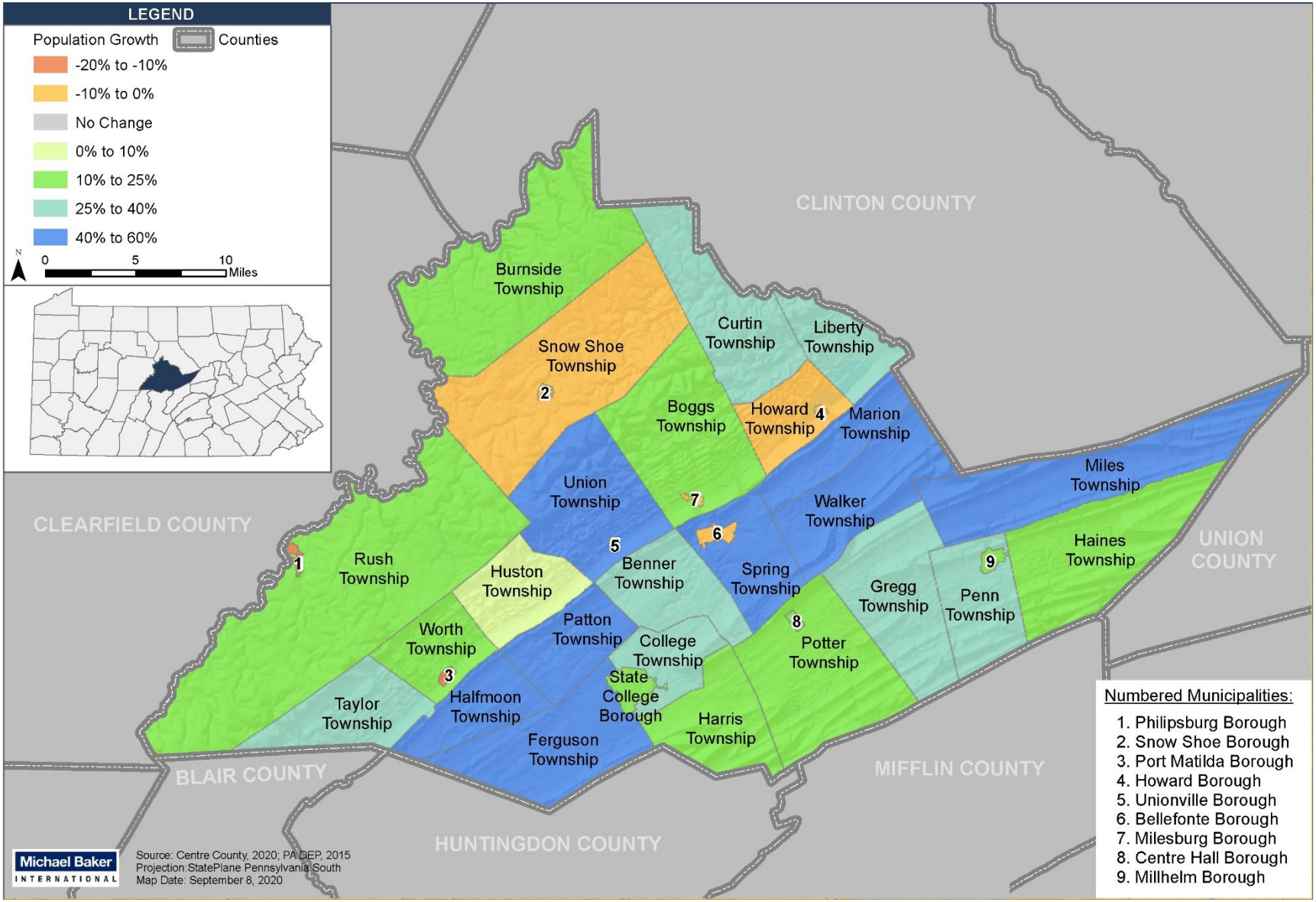
Countywide populations are expected to continue increasing in the future. Population projections issued by the PA DEP show a continued trend in population gain for the County as a whole, as shown in Table 4.4-6. PA DEP projects that the county population will increase by 28 percent between 2010 and 2040. These are the most current population projections to date. 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. This will likely result in increased development pressure on both urbanized areas such in the vicinity of State College Borough and the Centre Region Planning District.

Table 4.4-7: Centre County population data and projections (U.S. Census, 2010; PA DEP, 2015a)

DATA	POPULATION	PERCENT CHANGE
2000 Census	135,320	13.8%
2010 Census	153,990	
Percent Change 2000 – 2010		
2020 Projection	166,921	8.4%
Percent Change 2010 – 2020		
2030 Projection	182,921	9.6%
Percent Change 2020 – 2030		
2040 Projection	197,168	7.8%
Percent Change 2030 – 2040		
Percent Change 2000 – 2040		45.7%
Percent Change 2010 – 2040		**28.0%**

Figure 4.4-3 displays the percent of growth or decline in municipal population between years 2010 and 2040 in Centre County, as estimated by the PA DEP. The majority of municipalities in Centre County are projected to experience a growth in population between 2010 and 2040. Walker and Ferguson Townships are projected to grow at a rapid rate of over 55 percent during this time, while other communities like Huston Township are projected to remain relatively stable. Of the total 35 municipalities, eight are projected to lose population by 2040 (Bellefonte Borough, Howard Borough, Howard Township, Milesburg Borough, Philipsburg Borough, Port Matilda Borough, Snow Shoe Township, and Unionville Borough).

Figure 4.4-3: Projected Population Growth from 2010-2040 in Centre County



The two major development nodes of Centre County include the Centre Region and Bellefonte Borough. The predominant population center is the Centre Region, which is a center of commercial and business enterprises and is the most rapidly developing area of the County. With the presence of the Pennsylvania State University, areas immediately surrounding the University Park Campus have housing and density characteristics that resemble some of the larger metropolitan areas in the Commonwealth, even though much of the rest of Centre County is quite rural. For example, this area possesses a high concentration of multi-unit (10 or more) structures, indicating a high-density population, needed to house the student population and workers at the university and related service industries.

The second most populous and growing area is the Nittany Valley Region, which includes the County seat, Bellefonte Borough. This region's mix of residential, commercial, and agricultural lands is shifting as housing and commercial development continues. The Penns Valley Region remains mostly rural with predominantly agricultural characteristics. However, as the County's population continues to grow, this area is beginning to feel the pressure of increasing subdivision and development. The Lower Bald Eagle, Moshannon Valley, Mountaintop, and Upper Bald Eagle regions are noted for their mountains, agricultural valleys, and forest lands. Though dotted with small, rural communities, much of these regions are sparsely populated.

Figure 4.4-4 illustrates contrast between the undeveloped and developed areas of the county. Figure 4.4-5 shows the overall growth for the planning regions, as calculated by Centre County.

Figure 4.4-4: Centre County Developed and Undeveloped Areas (CCPCDO, 2015)

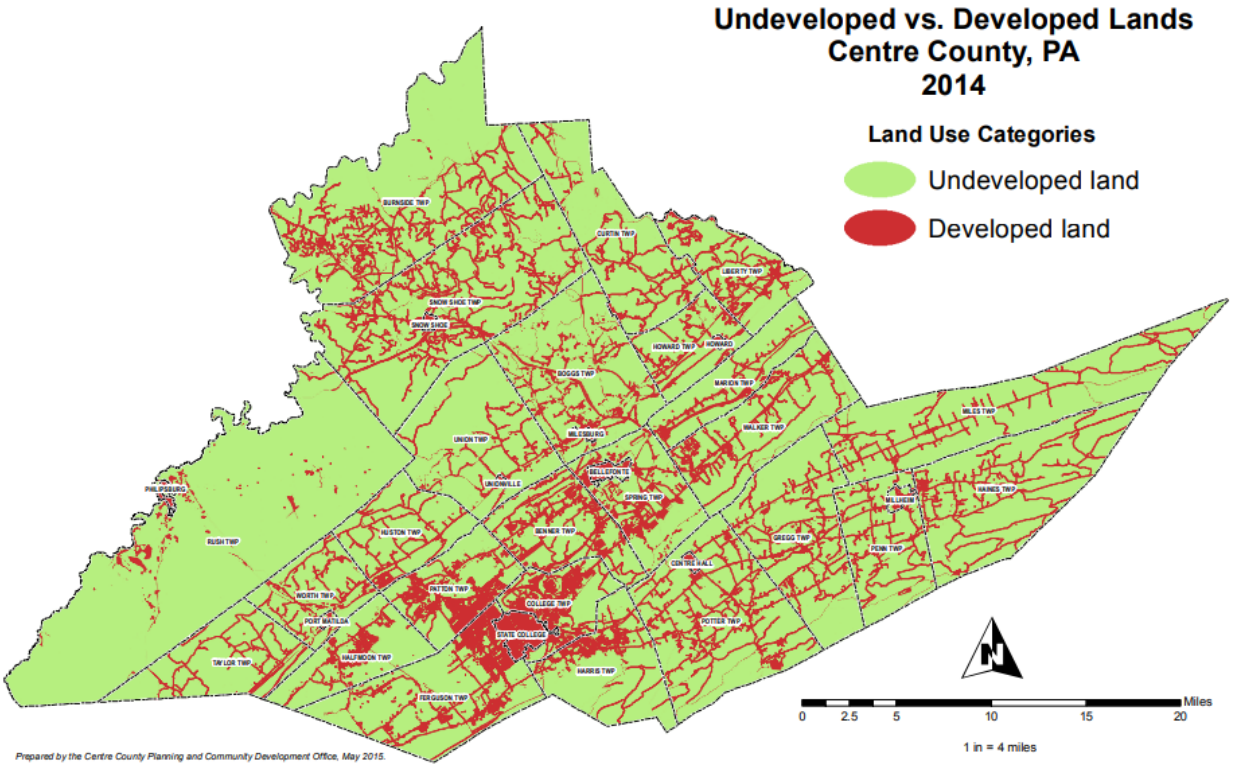
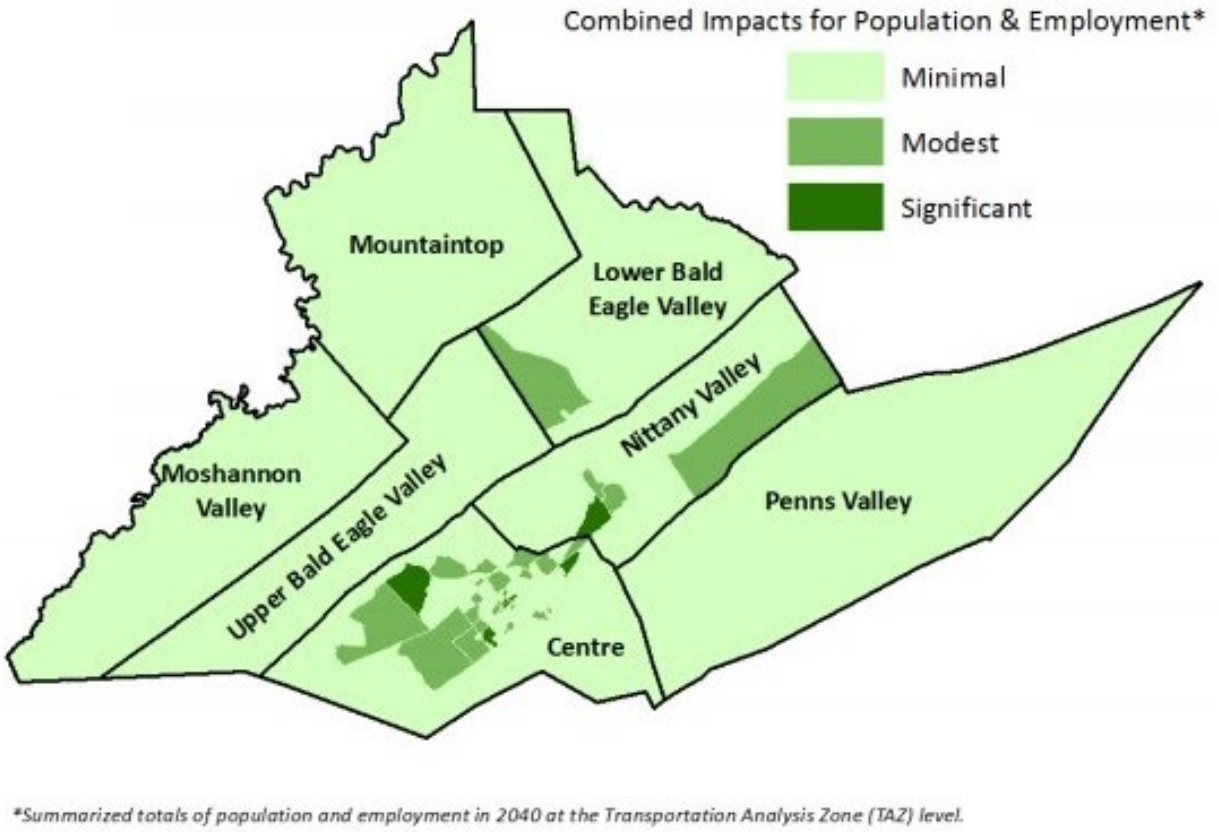


Figure 4.4-5: Centre County Overall Growth by Planning Region (CCPCDO, 2015)

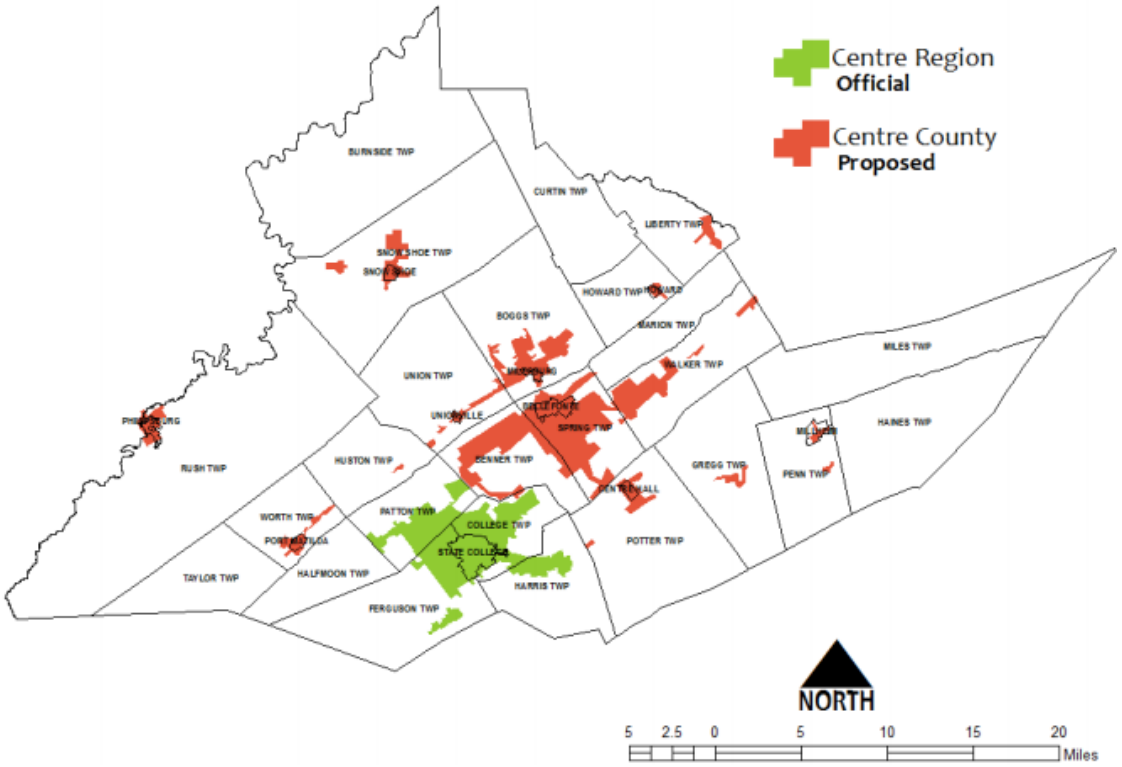


*Summarized totals of population and employment in 2040 at the Transportation Analysis Zone (TAZ) level.

With few exceptions, most land and structures within hazard areas are either homes or agricultural in nature; however, there are some seasonal homes in fire-prone or landslide-prone areas. For the other identified natural hazards, there can be no significant differentiation in locations likely to be impacted, so all future development must be required to take these risks into account. For a full discussion of development trends and land uses, see the 2003 Centre County Comprehensive Plan - Phase 1 and the 2015 Land Use section of the Centre County Comprehensive Plan – Phase II Implementation and Strategies.

As part of the County's comprehensive plan update, additional growth boundaries were proposed for the region, which would promote density development in areas where core infrastructure in the County is located. Figure 4.4-6 illustrates the current and proposed regional growth boundaries as depicted in the Economic Development section of the plan update entitled Comprehensive Plan Phase II – Implementation Strategies (CCPCDO, 2016). The plan also sets the goal of identifying available land and buildings for development, which could prevent the conversion of green space and promote redevelopment in areas with existing infrastructure.

Figure 4.4-6: Centre County Regional Growth Boundaries – Official and Proposed (CCPCDO, 2015)



Although a countywide future land use map is not currently available, a plan does exist for the Centre Region planning area. As mentioned previously, the Centre Region acts as the employment and population hub for the County. Figure 4.4-7 displays the Future Land Use Plan for the Centre Region, as illustrated in 2013 Centre Region Comprehensive Plan. As seen in the map, projected land use for the area is primarily located within the regional growth boundary with residential and commercial uses surrounding the State College Borough and Penn State University's campus. Figure 4.4-8 displays the Future Land Use plan for the Nittany Valley Region, as described in the 2019 Comprehensive Plan Update. The region is primarily comprised of conserved natural and agricultural lands with identified growth areas for residential and commercial uses. Figure 4.4-9 displays the draft Future Land Use plan for the Penns Valley Region, as described in the draft 2025 Comprehensive Plan Update. The majority of this region is conserved forest and agricultural lands with designated areas for high density residential growth.

In addition to population growth, historical development data through recoded subdivision and land development activity provides insight into where growth is occurring in the County. The CCPCDO publishes annual reports on subdivision and land development activity in the County. Table 4.4-7 displays the total number of recorded new files and plans for subdivision and land development in Centre County by regional planning area from 2015 to 2018. As seen from Table 4.4-7, the greatest share of growth in the County has occurred in the Centre Region, which annually accounts for more than one-third of the County's growth. The Nittany Valley and Penns Valley Regions account for the next largest share of overall growth in the County.

Figure 4.4-7: Future Land Use in the Centre Region (CRPA, 2013)

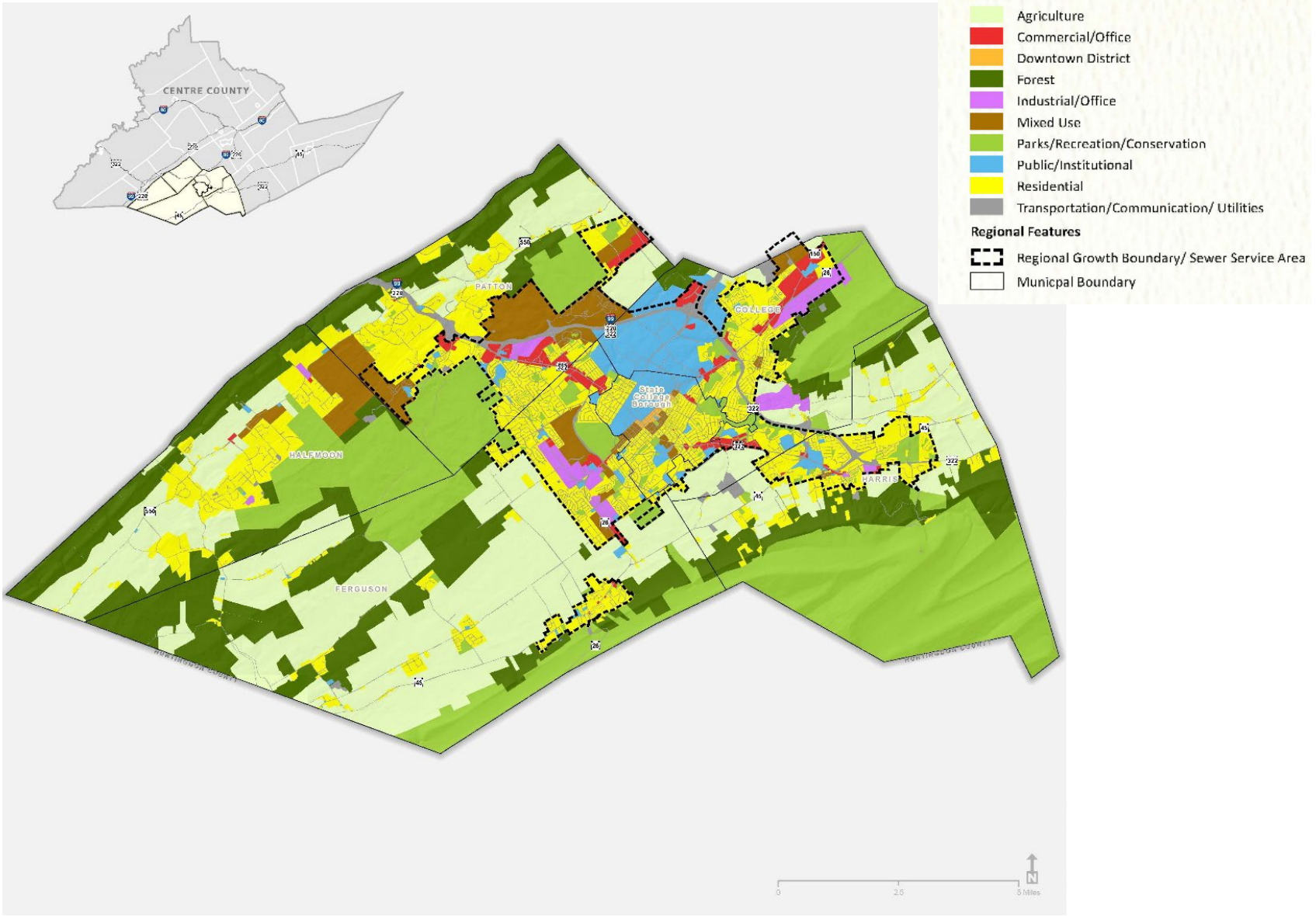


Figure 4.4-8: Future Land Use in the Nittany Valley Region (Nittany Valley Region Planning District, 2019)

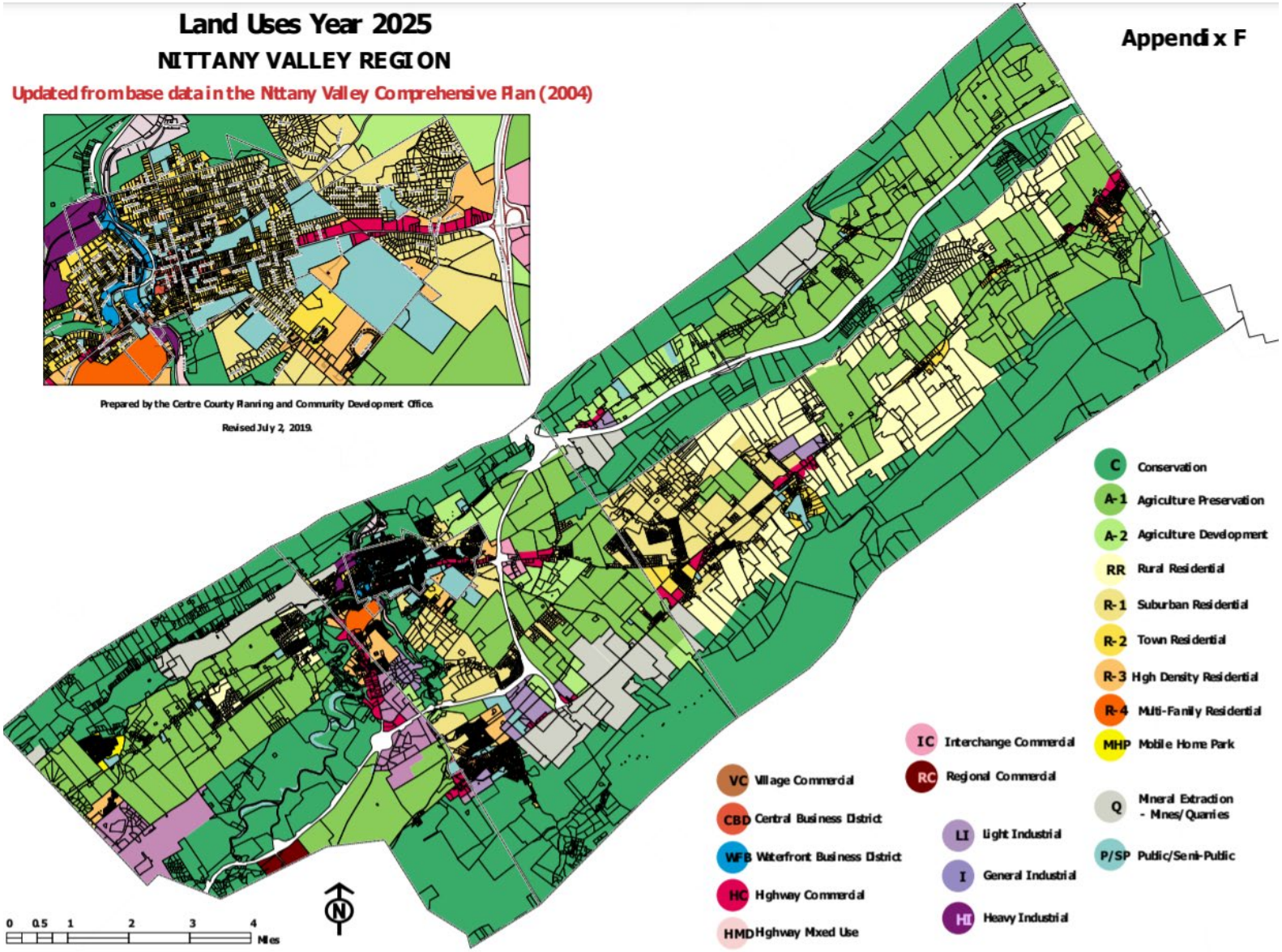


Figure 4.4-9: Future Land Use in the Nittany Valley Region (Penns Valley Region Planning District, 2020)

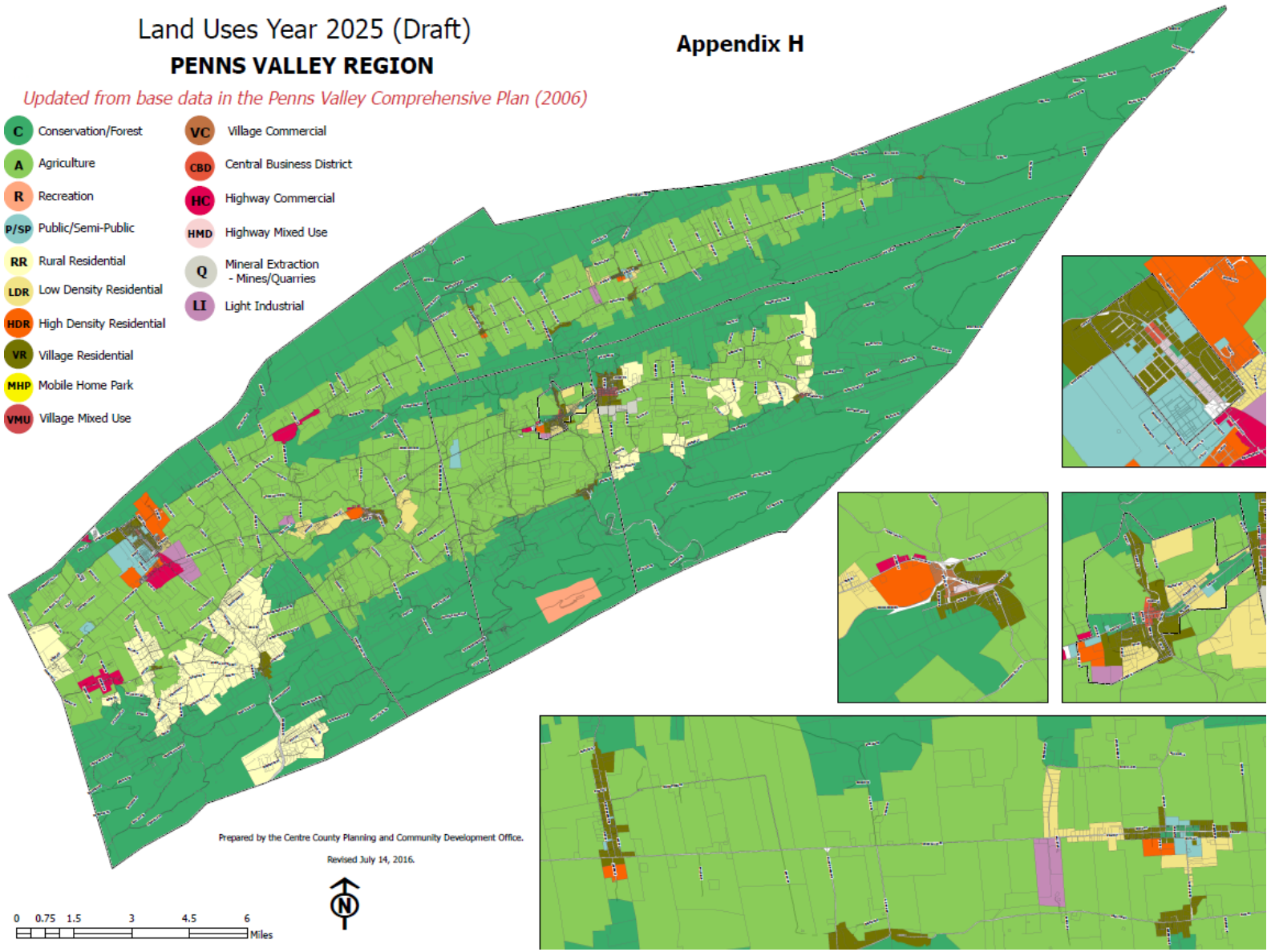


Table 4.4-7: Centre County Subdivision and Land Development Data (CCPCDO, 2018)

PLANNING REGION	2015		2016		2017		2018	
	NEW FILES CREATED	TOTAL RECORDED PLANS	NEW FILES CREATED	TOTAL RECORDED PLANS	NEW FILES CREATED	TOTAL RECORDED PLANS	NEW FILES CREATED	TOTAL RECORDED PLANS
Centre Region	77	90	73	69	80	89	81	71
Lower Bald Eagle Valley Region	10	10	16	13	10	7	19	17
Nittany Valley Region	35	29	27	33	41	27	43	34
Moshannon Valley Region	10	7	9	8	4	7	4	3
Mountaintop Region	13	9	9	9	6	4	10	9
Penns Valley Region	36	18	34	20	40	31	33	20
Upper Bald Eagle Region	9	8	17	14	19	10	15	13
COUNTY TOTALS	190	171	185	166	200	175	205	167

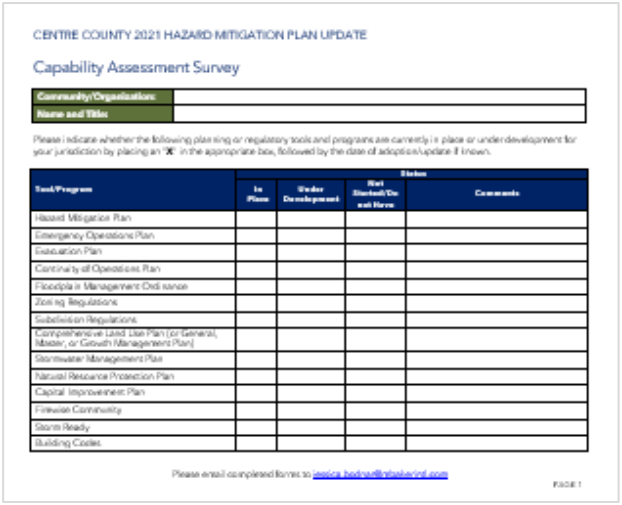
Making use of the analysis of Centre County's current and future population and development trends, it is important to explore how these projected changes may influence the County's future vulnerability to the profiled hazards. Hazard vulnerability and loss potential will be higher in the places of higher density throughout the County, so as areas continue to grow and densify, these communities might become more vulnerable to hazards. 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.

This updated plan can be used to inform ongoing land use and other planning efforts by the County. The analysis and associated maps within this Plan Update can assist Centre County in accomplishing their goals of development and redevelopment and actions to make areas less prone to the negative impacts of hazards.

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 Centre 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.



CENTRE COUNTY 2021 HAZARD MITIGATION PLAN UPDATE

Capability Assessment Survey

Community/Organization:	
Name and Title:	

Please indicate whether the following planning or regulatory tools and programs are currently in place or under development for your jurisdiction by placing an 'X' in the appropriate box, followed by the date of adoption/update if known.

Tool/Program	Status			
	In Place	Under Development	Not Started/Do not Have	Comments
Hazard Mitigation Plan				
Emergency Operations Plan				
Evacuation Plan				
Continuity of Operations Plan				
Floodplain Management Ordinance				
Zoning Regulations				
Subdivision Regulations				
Comprehensive Land Use Plan (or General, Master, or Growth Management Plan)				
Stormwater Management Plan				
Natural Resource Protection Plan				
Capital Improvement Plan				
Firewise Community				
Storm Ready				
Building Codes				

Please email completed forms to jessica.bednar@pasda.psu.edu

PAGE 1

The 2004 HMP identified the presence of local plans, ordinances, and codes in each municipality. It also specified local, state, and federal resources available for mitigation efforts. Through responses to the Capability Assessment Survey distributed to all municipalities and input from the HMSC, the 2010 HMP provided an updated inventory of the most critical local planning tools available 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 administering the NFIP. The 2015 HMP provided an update to the 2010 findings, through data collected from the County and participating municipalities. 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.

To accomplish this, a number of documents were reviewed as part of this Plan Update. While some information has been derived from the 2010 and 2015 Plans and updated where applicable, additional documents have been identified and reviewed for purposes of integration into other local planning mechanisms. Several plans and ordinances at the County and municipal level were reviewed, and a summary of options to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms is provided.

The Mitigation Strategy, including the goals and actions, should be incorporated into relevant planning mechanisms based on their pertinence and relevance to specific plans and ordinances. For example, all structural projects should be included in the Capital Improvement Program. Land use and zoning related projects should be incorporated into the next update of the Community's Comprehensive Plan and Zoning Ordinance through collaboration with Planning and Zoning departments. Likewise, information from relevant planning documents was used to inform and update the Hazard Mitigation Plan. A general list of relevant plans and documents and corresponding areas for incorporation are listed below:

Figure 5.1-1: Relevant Departments and Documents

RELEVANT DOCUMENTS	HAZARD MITIGATION PLANNING ELEMENTS
Comprehensive Plan/Land Use Plan, Zoning/Subdivision Regulations, Floodplain Ordinance	Demographic data, land use, development trends, and floodplain management information
Stormwater Management Plan, Sediment and Erosion Control Plan, Long Range Transportation Plan	Stormwater management and infrastructure data and projects
Evacuation Plan, Emergency Operations/Response Plan	All-hazards information for evacuation, response, and recovery
Climate Action Plan, Dam Safety Regulations	Risk and vulnerability data, and storm/floodwater management
Recreation and Greenway Plan	Land preservation strategies

5.2 CAPABILITY ASSESSMENT FINDINGS

Centre County and participating jurisdictions have a wide 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 Centre 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 2017. 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

- Phase I of the Centre County Comprehensive Plan was adopted in 2003. A comprehensive plan is a policy document identifying community goals and objectives for future growth and development. In Centre County, this is the policy basis for zoning decisions and other land development policies countywide. Phase II is currently underway which involves developing Implementation Strategies for the goals and objectives, as well as updating sections of the Comprehensive Plan as necessary. Since the 2015 Update, ten implementation strategies and chapter updates have been published, covering topics including Land Use (2016), Energy Conservation (2016), Public Safety (2017), Communications and Information Technology (2018), and Agriculture (2020).
- The Centre County Long Range Transportation Plan (LRTP) is the official transportation plan for the metropolitan area. LRTPs are used to guide a region's planning for a 20-year horizon. The LRTP documents current and future transportation demand and identifies long-term improvements and projects to meet those needs. The current long-range plan, LRTP 2050, was adopted in September 2020 (CCMPO, 2020a).
- The Centre County Recreation and Greenway Plan, 2009, was developed to assist with creating a countywide network of greenways for both human activity and natural infrastructure. This plan looks at land resources and identifies areas offering opportunities for preserving and protecting natural resources (CCPCDO, 2009).
- After FEMA provides a municipality with regulatory flood hazard information, they are required to adopt a floodplain ordinance that meets or exceeds the minimum NFIP requirements in order to participate in the NFIP. The purpose of these overriding regulations is to ensure that participating communities take flood hazard data into account when acting on land use and management. Floodplain ordinances in Centre County are included in the zoning ordinances of individual municipalities. The required free board is 1.5 feet above base flood elevation and no building permits are issued for

structures in the floodway. Elevation certificates are required by all municipalities for structures in the floodplain. More on floodplain ordinance administration can be found below in *Section 5.2.1.3*.

- Subdivision and land development ordinances 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 and Subdivision regulations are administered similarly through the Zoning Ordinance and the Centre County Subdivision and Land Development Ordinance (SALDO) (CCPCDO, 2018). Communities can elect to opt-in and have the community administer their zoning and subdivision regulations or opt out and develop their own zoning and subdivision ordinance. While the County has no control over the municipalities that have their own zoning ordinances, these municipalities still must meet the Act 247 guidelines – State Municipal Planning Code.
    - The CCPCDO oversees the administration of subdivision regulations for 25 of the County's municipalities under the Centre County SALDO. Ten municipalities in the County administer their own Subdivision Ordinances.
    - 28 municipalities in the County have adopted and enforce a zoning ordinance. Zoning in all remaining municipalities is managed through the County's SALDO.
        - 20 of these municipalities specifically regulate development of activities in forested lands and provide future land use controls in these areas. Current forest zoning district in the county can be seen in Figure 5.2-1.
        - Three municipalities – Ferguson, Harris, and Patton Township – regulate development near mountain ridges through the use of special overlay zoning districts. These are defined to meet each municipality's current and future development challenges; generally steering development away from steeply sloped lands. Ridge overlay districts and ridge locations in Centre County can be seen in Figure 5.2-2.
- Stormwater Management Plans are prepared to comply with the Pennsylvania Stormwater Management Act (Act 167). These plans are intended to improve stormwater management practices, mitigate potential negative impacts from future land uses, and to improve the condition of impaired waterways. This type of plan provides local ordinances that incorporate standards and criteria to manage and maintain peak runoff flows throughout the combined watersheds as development occurs. Stormwater Management Plans exist for five watersheds in Centre County:
    - Spring Creek Watershed (2002)
    - Fishing Creek/Cedar Run Watershed (1995)
    - Buffalo Creek Watershed (1998)
    - Kishacoquillas Creek Watershed (2003)
    - White Deer Watershed (2003)

Figure 5.2-1: Centre County Forest Zoning Districts (CCPCDO, 2013)

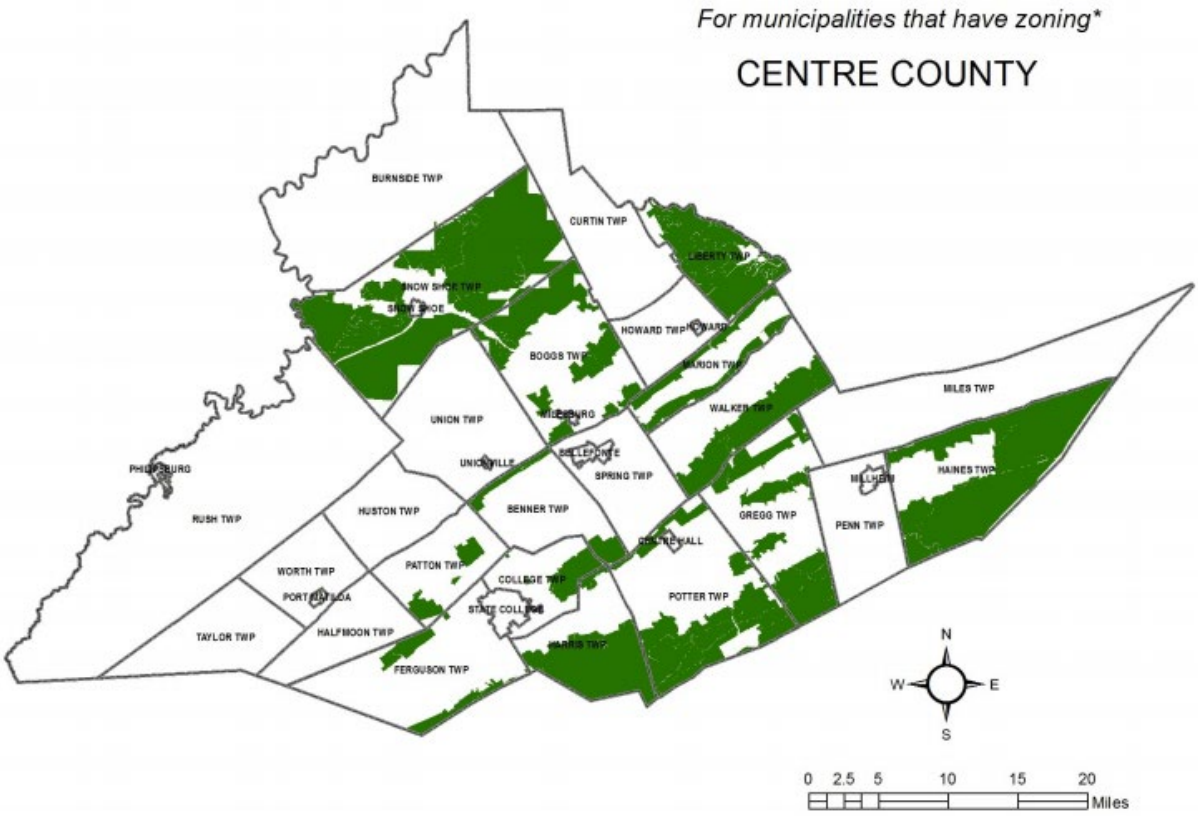
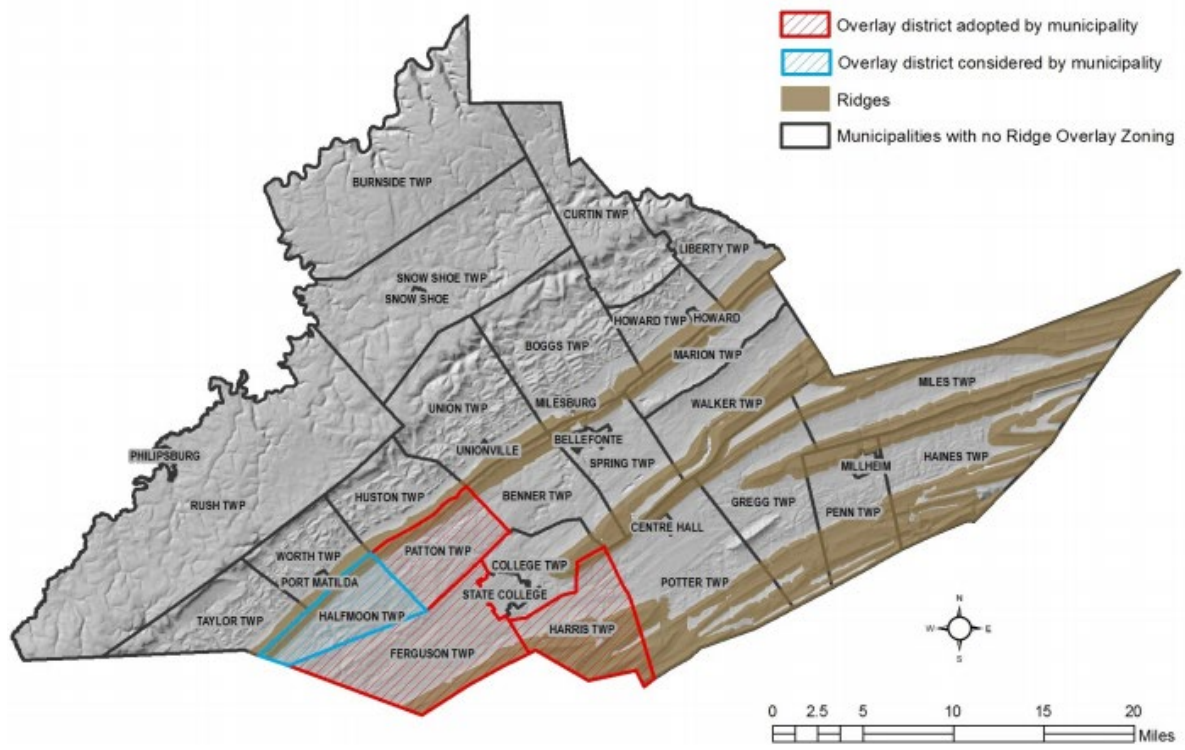


Figure 5.2-2: Centre County Municipalities with Ridge Overlay Districts (CCPCDO, 2013)



Watersheds in the county with detailed analyses conducted under past Act 167 Plans have specific regulations for stormwater management. All municipalities are required to adopt the model ordinance or amend existing ordinances to be consistent with the standards and criteria set forth in the Plan. If municipalities do not have the capabilities to review plans for consistency with the standards and criteria set forth in the Plan, they will be responsible to designate a representative organization that can complete the review on the municipality's behalf. A total of 16 out of 35 municipalities in Centre County have a stormwater ordinance in place (see Table 5.2-3). However, Centre County has a stormwater management requirement in its SALDO, which applies to the other 19 municipalities. It appears that outside of the Centre and Penns Valley planning regions, many municipalities within the County do not have an adopted stormwater management plan.

- The Commonwealth has adopted the 2018 UCC, which is the most recent update. All 35 municipalities in Centre County have since adopted these building codes (see Commonwealth of Pennsylvania Document Review, Bullet "B"). Residential construction in Centre County is also regulated by the International Residential Code (IRC), which was most recently updated in 2015. The IRC regulates the construction, alteration, movement, enlargement, replacement, repair, renovation, and demolition of one- or two-family dwellings and townhouses not more than three stories above grade in height. 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.
- Sediment and Erosion Control Regulations are administered by the Centre County Conservation District, on behalf of the PA Department of Environmental Protection (PA DEP). Municipalities that administer their own SALDO are responsible for including stormwater regulations in the SALDO. The level of enforcement of these regulations varies by municipality and is based on staff availability and technical capability. If a project requires a sediment and erosion control permit, a plan is required to be submitted (Centre County Conservation District, 2020).
- The Centre County Emergency Operations Plan (EOP) was most recently updated in 2016 and reviewed in 2018. This plan prescribed emergency response coordination guidelines for the County, serving as an emergency management link between local municipalities and state government while incorporated the federal organizational concepts of the National Response Framework (NRF). The Emergency Management Services Code (PA Title 35) requires that all municipalities in the Commonwealth have a Local EOP which is reviewed every two years. All municipalities in Centre County have a local EOP. Additionally, Penn State University has a Comprehensive Emergency Management Plan (2012). Centre County operates emergency services through the Emergency Communications Center. The County Emergency Services website includes listings for resources available from County assets. The CEMP outlines the most critical

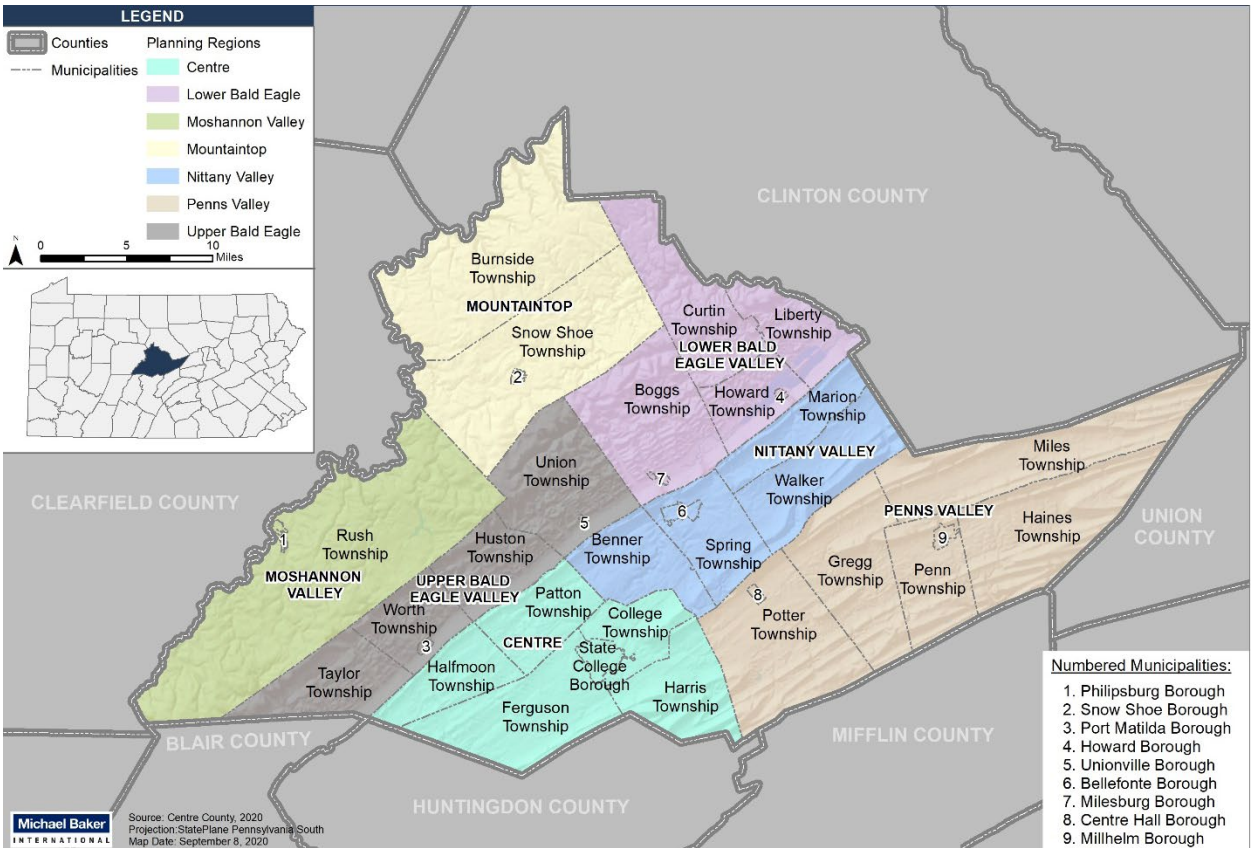
elements of the university's emergency management plan to inform the public on general processes at the school, and to provide a foundation upon which other universities can build their campus specific plans.

- Emergency Action Plans have been prepared for high hazard dams located in Centre County as well as those for which the inundation area includes part of Centre County. Each Emergency Action Plan addresses ways to safeguard lives and reduce property damage within the inundation area; procedures for effective dam surveillance; procedures for prompt notification of emergency management officials; warning and evacuation procedures; and emergency response actions that will be taken in the event of potential or imminent failure of the dam. Plans are typically prepared by dam owners and are reviewed by Centre County officials. Plans are not available to the public because they include sensitive information.
- The Centre County 911/Emergency Communications Standard Operating Procedures was revised in January 2017. This plan includes an EMS System Response Plan. The goal of the countywide response plan is to expedite responses by eliminating the delay of any agency that has low staffing and who will not be able to crew when being requested by the center for response to a 911 initiated call received through Centre County Emergency Communications Center.
- Penn State University published its most recent strategic plan, Our Commitment to Impact – 2016-2025, in 2015. One thematic priority in the plan is enhancing health on campuses and surrounding communities. The university plans to meet community health goals through collaborative partnerships and by informing government health policy. PSU has comprehensive capabilities to assist Centre County in pandemic and infectious disease mitigation and response (Penn State, 2015b).
- CCMPO updated its Coordinated Public Transit – Human Services Transportation Plan in 2012 (CCMPO, 2012). SEDA-COG published their most recent Coordinated Public Transit Plan in 2019 (SEDA-COG, 2019). These plans identify the transportation needs for individuals with disabilities, older adults, and people with low incomes and provide strategies for accommodation. During hazard response, these populations should be prioritized for assistance in evacuations.

LOCAL/MUNICIPAL DOCUMENT REVIEW

- Centre County is split into seven Planning Regions, as shown in Figure 5.2-3. CCPCDO works with each regional planning agency to develop comprehensive plans in these regions. To date, three regions have developed comprehensive plans: Centre Region (2013), Nittany Valley Region (2019), and Penns Valley Region (2006). Currently, CCPCDO is working with the Upper Bald Eagle Region Planning Agency to develop a comprehensive plan.

Figure 5.2-3: Centre County Planning Regions



- The Centre Regional Planning Agency (CRPA) provides regional and local planning services to municipalities in the Centre Region: College Township, Ferguson Township, Halfmoon Township, Harris Township, Patton Township, and State College Borough. This is primarily through the development of small area plans that establish a long-range vision to guide the future growth and development of specific areas. Plans are then adopted and implemented by local municipalities. The following table lists these plans:

Table 5.2-1: Small Area Plans Developed by the CRPA

YEAR OF ADOPTION	PLAN TITLE	AREA COVERED
2008	The State College Land Area Plan	Borough of State College and parts of College and Ferguson Townships
2012	The Halfmoon and Patton Township Area Plan	Halfmoon and Patton Townships
2016	Boalsburg Small Area Plan	Boalsburg area in Harris Township
2018	Halfmoon Township Small Area Plan	The designated mixed-use area in the eastern part of Halfmoon Township
2019	Ferguson Township – Pine Grove Mills Small Area Plan	The Pine Grove Mills area in Ferguson Township

- The Nittany Valley Region adopted its most recent Comprehensive Plan Update in 2019. The Nittany Valley planning region covers Bellefonte Borough, Benner Township, Marion Township, Spring Township, and Walker Township. The plan identifies future land use goals for the area, as well as gaps in local emergency response services. Future land use maps identify conservation areas where development is limited, as well as mines and quarries which should have ongoing monitoring to prevent environmental hazards.
    - While County governments are required by law to adopt a Comprehensive Land Use Plan, this is optional for local municipalities. All but three municipalities in Centre County have adopted comprehensive land use plans (*the Brough of Unionville, Township of Curtin, and the Township of Taylor*).
- Centre Region Council of Governments is currently developing *'Centre Region Resilience,'* a regional Climate Action and Adaptation Plan (CAAP) for the six municipalities in the Centre Region. The plan will build a diverse coalition of community partners to develop mitigation actions against climate change. Specifically, the plan is looking to mitigation the region's contribution to greenhouse gas emissions and to adapt to changing climate conditions. Changing climate conditions will directly impact the range and magnitude of natural hazards including floods and hurricanes. Long-term plans to reduce emissions are essential towards stopping climate change to begin with (CRCG, 2020a).
- Bellefonte Borough developed a Climate Action Plan (CAP) in 2020. Similar to the Centre Region CAAP, the Bellefonte Borough CAP looks to mitigate greenhouse gas emissions. Bellefonte identifies a number of mitigation objectives and actions to move towards this goal (Bellefonte Borough, 2020).
- The Public Works and Planning & Zoning Departments in Ferguson Township drafted an amendment to the Township's SALDO to establish a new Tree Preservation section. The ordinance will only apply to trees during land development and not existing properties in Ferguson. The ordinance will provide incentives to developers that plan additional trees in their developments (Ferguson Township, 2020). Tree preservation is a nature-based solution that can help manage stormwater and mitigate flood impacts.
- Halfmoon Township created an Open Space Preservation Board in 1999 to acquire and manage open space properties in the municipality. This has resulted in a variety of conservation projects. In between 2006 and 2011, 25 new properties with 1,776 acres were conserved (Halfmoon Township, n.d.).
- Centre County municipalities employ additional types of planning and regulatory controls, including:
    - 11 municipalities have regulations to require parkland designation for applicable residential development.
    - 17 municipalities have purchased easements through the County's Agricultural Land Preservation Board in locations identified as Agricultural Security Areas.

- 16 municipalities have adopted stormwater management ordinances. 18 of the remaining municipalities are regulated by Centre County's stormwater management requirements in its SALDO. Taylor Township is regulated under its own municipal SALDO (Centre County, 2019b).

5.2.1.1 Participation in the National Flood Insurance Program

The Pennsylvania Floodplain Management Act (Act 166 of 1978) requires every municipality with flood hazard areas identified by the FEMA to participate in the NFIP and permits all municipalities to adopt floodplain management regulations. It is in the interest of all property owners in the floodplain to keep development and land usage within the scope of the floodplain regulations for their community. This helps keep insurance rates low and makes sure that the risk of flood damage is not increased by property development.

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 with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP and the Pennsylvania Flood Plain Management Act (Act 166), based on their 44 CFR 60.3 level of regulations. As new Flood Insurance Rate Maps (FIRMs) are published, the Pennsylvania State NFIP Coordinator at DCED works with communities to ensure the timely and successful adoption of an updated floodplain management ordinance by reviewing and providing feedback on existing and draft ordinances. In addition, DCED provides guidance and technical support through Community Assistance Contacts (CAC) and Community Assistance Visits (CAV).

As stated in Section 4.3.4, 34 of 35 municipalities in Centre County participate in the NFIP. Table 5.2-2 shows whether the municipality is participating in the NFIP, whether the municipality is in good standing, the number of policies they have, and the total amount of premium and coverage for each municipality. Since the 2015 HMP, Snow Shoe Borough was suspended from the NFIP.

Table 5.2-2: Centre County NFIP Information by Municipality (CIS, 2020)

COMMUNITY	PARTICIPATION STATUS	COMMUNITY IN GOOD STANDING	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE
Bellefonte Borough	Participating	Yes	9	$2,669,055
Benner Township	Participating	Yes	7	$1,324,397
Boggs Township	Participating	Yes	34	$6,738,775
Burnside Township	Participating	Yes	0	$0
Centre Hall Borough	Participating	Yes	0	$0
College Township	Participating	Yes	17	$5,171,372
Curtin Township	Participating	Yes	7	$661,782
Ferguson Township	Participating	Yes	21	$5,537,547

Table 5.2-2: Centre County NFIP Information by Municipality (CIS, 2020)

COMMUNITY	PARTICIPATION STATUS	COMMUNITY IN GOOD STANDING	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE
Gregg Township	Participating	Yes	13	$1,649,688
Haines Township	Participating	Yes	8	$1,283,631
Halfmoon Township	Participating	Yes	6	$1,270,966
Harris Township	Participating	Yes	7	$1,641,716
Howard Borough	Participating	Yes	1	$28,116
Howard Township	Participating	Yes	1	$161,486
Huston Township	Participating	Yes	6	$790,315
Liberty Township	Participating	Yes	17	$1,789,553
Marion Township	Participating	Yes	1	$210,496
Miles Township	Participating	Yes	27	$3,764,262
Milesburg Borough	Participating	Yes	24	$2,685,853
Millheim Borough	Participating	Yes	17	$4,528,357
Patton Township	Participating	Yes	19	$2,172,451
Penn Township	Participating	Yes	11	$1,599,196
Philipsburg Borough	Participating	Yes	4	$751,025
Port Matilda Borough	Participating	Yes	4	$994,521
Potter Township	Participating	Yes	20	$2,976,830
Rush Township	Participating	Yes	0	$0
Snow Shoe Borough	Suspended	No	6	$838,674
Snow Shoe Township	Participating	Yes	0	$0
Spring Township	Participating	Yes	26	$6,193,713
State College Borough	Participating	Yes	12	$3,571,449
Taylor Township	Participating	Yes	5	$1,121,703
Union Township	Participating	Yes	3	$841,317
Unionville Borough	Participating	Yes	3	$158,901
Walker Township	Participating	Yes	5	$874,542
Worth Township	Participating	Yes	3	$1,502,582
COUNTY TOTAL			344	$65,504,271

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 Centre 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.

A total of 19 municipalities submitted the 2021 NFIP Survey. The following information is summarized to document how the County currently assists municipalities in addressing NFIP compliance and requirements:

- The County makes the FIRM and FIS Reports available to the public for review at the County Records Center, located at the Willowbank Building in Bellefonte Borough. The Office serves as the depository for all County plans and ordinances and includes most flood-related information.
- Publication of the effective countywide FIRM occurred on May 4, 2009 and January 16, 2015. Digital flood hazard information provided by FEMA greatly enhances mitigation capabilities as they relate to identifying flood hazards. Residents and municipal officials are provided with mapping assistance from the Centre County GIS Office, CCPCDO, and the Centre County OES upon request.
- As shown in Table 5.2-3, out of 35 total municipalities in the County, 25 are under the jurisdiction of the Centre County SALDO. Ten municipalities administer their own SALDOs. 28 municipalities administer their own zoning codes, while all other communities' zoning is under the jurisdiction of the Centre County SALDO. Local municipalities, not under the jurisdiction of the County, are responsible for all third party LOMR requests to either be: 1) submitted to FEMA through the local municipality, or 2) provided with evidence that the local municipality has been notified of the LOMR requests to FEMA.
- Seven communities are under County jurisdiction for both zoning and subdivision land use. 18 additional communities are under County jurisdiction for subdivision and land use only. Centre County SALDO contains floodplain language, restrictions, definitions, and prohibitions. Under the Centre County SALDO developers must first get a permit from the Zoning Office housed in CCPCDO. The Zoning Officer also acts as the Floodplain Administrator for these seven municipalities.
- Several communities that administer their zoning and floodplain regulations locally contract with private consulting firms to support these functions. For example, Rush Township utilizes an engineering consultant to serve as the local engineer and zoning officer.
- CCPCDO provides advice and guidance to the public regarding elevation certificated and LOMAs. However, the NFIP is a program administered through FEMA. Through its

Flood Hazard Mapping Program, FEMA maintains and updates data through FIRMs. Copies of documents that pertain to changing or correcting the FIRM are available through FEMA and are also available in the offices of the local municipalities.

- CCPCDO and Centre County GIS Office provide advice and guidance to the pubic in interpreting the FIRM and flood studies.

In addition, some local ordinances include measures that go beyond the minimum standards and requirements for floodplain management.

- Ferguson Township adopted a Sourcewater Protection Ordinance in 2019 that prohibits new structures in floodplains unless they can demonstrate the impact will be less than one percent per year.
- Benner Township, Haines Township, Halfmoon Township, and Spring Township prohibit new construction in the SFHA.
- Unionville Borough adopted a Source Water Protection Plan that encourages safer production and storage of chemicals.

Table 5.2-3 includes the regulatory capabilities that were identified by the municipalities during the planning process, as well as through Centre County records. All 35 communities in Centre County have adopted a building permit ordinance. Several municipalities have their own planning commissions. Any municipality without one is supported through CCPCDO. A few municipalities have adopted additional ordinances supporting hazard mitigation and environmental resilience.

- Gregg Township, Haines Township, Halfmoon Township, Howard Borough, Patton Township, Penn Township, Penn State University have all adopted Natural Resources Protection Plans.
- Centre Hall Borough, Ferguson Township, Gregg Township, Haines Township, Millheim Borough, Penn Township, Snow Shoe Township, and Penn State University have adopted Emergency Operations Plans that include Evacuation Plans and Continuity of Operations Plans.

Table 5.2-3: Summary of Planning Tools Adopted by Each Municipality in Centre County (Centre County, 2019b)

COMMUNITY	LEVEL OF FLOODPLAIN ORDINANCE REGULATIONS	ADOPTED COMPREHENSIVE PLAN	MUNICIPAL SALDO APPLIES	COUNTY SALDO APPLIES	ZONING ORDINANCE	PARKLAND DEDICATION ORDINANCE	AGRICULTURE SECURITY AREA	STORM-WATER ORDINANCE
Centre County	N/A	X		X				
CENTRE PLANNING REGION								
College Township	D	X	X		X	X	X	X
Ferguson Township	C	X	X		X	X	X	X
Halfmoon Township	B	X	X		X	X	X	X
Harris Township	D	X	X		X	X	X	X
Patton Township	B	X	X		X	X	X	X
State College Borough	C	X	X		X	X		X
LOWER BALD EAGLE VALLEY PLANNING REGION								
Boggs Township	D	X		X	X			X
Curtin Township	C			X				
Howard Borough	C	X		X	X			
Howard Township	C	X		X				
Liberty Township	C	X	X		X			X
Milesburg Borough	D	X		X	X			
NITTANY VALLEY PLANNING REGION								
Bellefonte Borough	C	X	X		X			X
Benner Township	D	X		X	X		X	X
Marion Township	C	X		X	X	X	X	X
Spring Township	D	X	X		X	X	X	X
Walker Township	C	X		X	X	X	X	X

Table 5.2-3: Summary of Planning Tools Adopted by Each Municipality in Centre County (Centre County, 2019b)

COMMUNITY	LEVEL OF FLOODPLAIN ORDINANCE REGULATIONS	ADOPTED COMPREHENSIVE PLAN	MUNICIPAL SALDO APPLIES	COUNTY SALDO APPLIES	ZONING ORDINANCE	PARKLAND DEDICATION ORDINANCE	AGRICULTURE SECURITY AREA	STORM-WATER ORDINANCE
MOSHANNON VALLEY PLANNING REGION								
Philipsburg Borough	C	X		X	X			
Rush Township	C	X	X		X			
MOUNTAINTOP PLANNING REGION								
Burnside Township	B	X		X				
Snow Shoe Borough	N/A	X		X	X			
Snow Shoe Township	C	X		X	X			
PENNS VALLEY PLANNING REGION								
Centre Hall Borough	N/A	X		X	X			
Gregg Township	B	X		X	X	X	X	X
Haines Township	D	X		X	X		X	
Miles Township	B	X		X			X	
Millheim Borough	C	X		X	X			
Penn Township	D	X		X			X	
Potter Township	B	X		X	X	X	X	X
UPPER BALD EAGLE VALLEY PLANNING REGION								
Huston Township	C	X		X	X		X	
Port Matilda Borough	C			X	X			
Taylor Township	N/A			X			X	
Union Township	C	X		X				
Unionville Borough	C	X		X	X			
Worth Township	C	X		X	X		X	

Many of the above stated higher standards adopted by municipalities such as freeboard requirements and addressing repetitive loss properties could be eligible for credit under the Community Rating System (CRS). The NFIP's CRS provides discounts on flood insurance premiums in communities that establish floodplain management programs that go beyond NFIP requirements. Under the CRS, communities received credit for more restrictive regulations; acquisition; relocation, or flood-proofing of flood-prone buildings, preservation of open space; and other measures that reduce flood damage or protect the natural resources and functions in floodplains.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the CRS in the NFIP, and expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS, and communities now receive credit toward premium reductions for activities that contribute to them.

Under CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet a minimum of three of the following CRS goals:

- Reduce flood losses
- Reduce damage to property
- Protect public health and safety
- Prevent increases in flood damage from new construction
- Reduce the risk of erosion damage
- Protect natural and beneficial floodplain functions
- Facilitate accurate insurance rating
- Promote the awareness of flood insurance

There are 10 CRS classes that provide varied reduction in insurance premiums. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities. The CRS recognizes 18 creditable activities that are organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness.

Currently, no communities in Centre County participate in CRS. CCPCDO conducted an assessment to determine the communities that would benefit most from voluntary participation in the program. To do so, the County examined the following criteria based on data provided by FEMA:

- Number of flood insurances policies in the SFHA,
- Number of structures (as well as percent of uninsured structures) in the SFHA,
- Municipalities with the highest total and average premiums,

- The "insurance gap" or the gap between the flood insurance in force and the market value of properties within a community, and
- Municipalities with the greatest percentage of land in the SFHA.

Figure 5.2-4 lists the outcome of the assessment and target communities for a CRS pilot program in Centre County. As noted in the figure below, a pilot program for the County would focus on the communities that fulfill the most assessment parameters (as outlined above). No update has been made since the 2015 HMP. Anecdotal evidence shows that communities do not have the capacity to administer the CRS program. One hurdle is the need to collect flood elevation certificates for new and substantially improved structures in the SFHA to demonstrate compliance with the community's floodplain ordinance. During the 2015 HMP planning cycle, FEMA Region 3 held a CRS training for local officials in Centre County. Centre County is continuing an ongoing process to find potential ways to participate in the CRS. Officials are currently looking into possibilities of administering the CRS at the County level. This will be dependent on administrative and governmental capabilities.

Figure 5.2-4: Centre County CRS Assessment

Target Communities for a CRS Pilot Program in Centre County based on the assessment parameters.

Municipality	Number of Policies	Number of Structures	Insurance Premiums	Insurance Gap	Coverage in Force	Percent Floodplain	Assessment Criteria
Milesburg	●	●	●		●	●	5
Boggs Twp	●	●	●	●	●		5
Ferguson Twp			●	●	●		3
College Twp				●	●		2
Gregg Twp		●		●			2
Millheim	●		●				2
Spring Twp	●			●			2
Bellefonte			●				1
Harris Twp					●		1
Liberty Twp						●	1
Penn Twp	●						1
Philipsburg						●	1
Port Matilda						●	1
Rush Twp		●					1
Unionville						●	1

Assessment: Focus on those communities that fulfill the most parameters.

For communities that participate in the NFIP, substantial damage determinations are required by local floodplain management ordinances. These rules must be in place for residents of a community to purchase flood insurance through the NFIP. The determination about whether a structure is "substantially damaged" is made at the local government level, generally by a building official or floodplain manager. Substantial damage applies to a structure in the SFHA for which the total cost of repairs is 50 percent or more of the structure's market value before the disaster occurred, regardless of the cause of damage. This percentage could vary among jurisdictions but must not be below NFIP standards. Preliminary damage assessments conducted by Centre County after a disaster can be used when making substantial damage determinations. If a building within the floodplain is determined to be substantially damaged after a disaster, it will need to be brought into compliance through methods such as elevating the structure and floodproofing utilities. This should be monitored by the local community in order to stay in compliance with the NFIP.

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 GIS, resource development staff or grant writers, and fiscal staff that can handle complex grant application processes.

A variety of administrative capability are established in Centre County and its jurisdictions. These capabilities can support the implementation of mitigation actions that are proposed in this plan These capabilities include:

- The Centre County Planning and Community Development Office provides professional planning services to citizens, communities, and municipalities in Centre County. The office is responsible for carrying out duties set forth in the Pennsylvania Municipalities Planning Code (PA Act 247 of 1968, amended and reenacted in 2017). Duties related to hazard mitigation planning include:
    - Preparing and updating the Centre County Comprehensive Plan
    - Administering the County's SALDO, and monitoring municipal SALDO regulations
    - Administering the Centre County Agricultural Land Preservation Board's PA Agricultural Conservation Easement (PACE) program

  - Assisting municipalities with preparing, modifying or reviewing plans and ordinances including comprehensive plans, capital improvements, zoning and subdivision ordinances, GIS mapping, and the NFIP.
  - Giving technical planning assistance to the County's seven regional planning areas
  - Representing the County on various committees, boards, and organizations throughout the county and region
  - Coordinating with the Centre County GIS Office
  - Offering technical assistance to public agencies and organizations including grant writing and administration
  - Providing staff support to Centre County's MPO

- The Centre County GIS Office performs mapping and spatial database maintenance work for various County departments including, Planning, 911, and the Conservation District. The office provides several open data resources for municipalities to use and can assist municipalities in specific projects.

- Transportation planning in the region is conducted through the Centre County Metropolitan Planning Organization (CCMPO). The MPO decides how the Federal and State transportation funds will be allocated in metropolitan region around State College. One of the primary roles and responsibilities of the CCMPO is the develop and update the LRTP, as mandated by federal transportation authorization legislation.

- The Centre County Office of Emergency Services coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazard events have on their community. A significant amount of information used to develop this plan was obtained from the emergency management coordinators. The OES also contains a Local Emergency Planning Committee (LEPC), which is responsible for overseeing Hazardous Materials Response Account and approving Off-site Emergency Response Plans. The LEPC is comprised of volunteers from Centre County OES, and a variety of agencies including police departments, fire companies, local elected officials, transportation officials, as well as the general public.

- Centre County 911, or PSAP (public service answering point), serves residents and businesses across the County with various types of emergency and non-emergency situations. This office maintains up to date telephone and mapping systems, and act as the primary contact for those needing police, ambulance, or fire assistance.

- Centre County Information Technology Services provides county residents and employees access to information and resources and support services. This office can assist municipalities and businesses in upgrading cyber-security and enhancing safety.

- The Centre County Conservation District provides local assistance to individuals and organizations that interact with the County's natural resources. Their mission is to work collectively to sustain and improve natural resources in Centre County.
- The Penn State Extension provides a wide range scientific data and information to individuals, businesses, and communities internationally. Municipalities can work with the Extension to conduct local environmental studies.
- There are a number of watershed associations in the Centre County region:
    - Spring Creek Watershed Association
    - Clearwater Conservancy
    - Trout Unlimited
        - Wood Duck Chapter
        - Spring Creek Chapter
    - Cold Stream Watershed
    - Penns Valley Conservation Association
    - Centre County Chapter of the Senior Environmental Corps
    - Susquehanna Watershed Coalition
    - The Chesapeake Bay Commission
- Clearwater Conservancy operates the Centre County Pennsylvania Senior Environmental Corps (CCPaSEC), which develops and supports teams of senior citizens who gather and publish data on water quality and streams in the County.
- The South Central Mountains Regional Task Force (SCMRTF) is a regional all-hazards emergency preparedness task force for eight counties in Central Pennsylvania: Bedford, Blair, Centre, Fulton, Huntingdon, Juniata, Mifflin, and Snyder. SCMRTF's preparedness activities address planning, prevention, and response; and enhance regional coordination capabilities in the event of multi-jurisdictional incidents. SCMRTF has three key programs, including developing, training, and exercising specialized response teams to augment first responder efforts; purchasing and providing procedures for the use of interoperable communications; and, planning and exercising for large scale public health events (SCMRTF, 2020). Additionally, SCMRTF places emphasis on collaborating with the private sector to ensure the security and resilience of privately owned businesses and infrastructure, especially those critical to countywide public health and operational continuity such as the energy, telecommunications, food processing, and transportation sectors. Though SCMRTF is an all-hazards group, it began as a counter-terrorism organization and maintains an extensive training program to mitigate the threat of terrorism for local emergency response entities as well as for the private sector.
- The Susquehanna Economic Development Association - Council of Governments (SEDA-COG) is a regional multi-county development agency which, under the guidance of a public policy board, provides leadership, expertise, and services to communities, businesses, institutions, and residents. With their partners, the region's chamber of

commerce and industrial development groups, SEDA-COG provides services free of charge to companies in an 11-county service area in Central Pennsylvania.

- Centre County and Penn State University are both certified as StormReady Communities by NWS. The Storm Ready program was established to help local governments improve the timeliness and effectiveness of hazardous weather-related warnings for the public. By participating in this program, local agencies can earn recognition for their jurisdiction by meeting the guidelines established by NWS in partnership with Federal, State, and local emergency management professionals. The certification also makes Centre County and its municipalities eligible for 25 points in the Community Rating System, awarded to local governments that meet the flood threat recognition system.
- The Pennsylvania State Association of Township Supervisors (PSATS) strives to preserve and strengthen township government and to improve involvement for townships in the state. PSATS sponsors training opportunities to provide township officials with the information and skills they need to meet the challenges of township office.
- Penn State University created the International Center for the Study of Terrorism (ICST) in 2006. The mission of ICST is to engage in and promote the scientific study of terrorism and political violence. In doing so, ICST creates multidisciplinary, cross-national research teams, drawing strongly but not exclusively from the social and behavioral sciences, to respond to needs and opportunities in the broad areas of terrorism and counterterrorism. The overarching goal of ICST is to provide actionable knowledge and a conceptual basis to policy-relevant and operational counterterrorism activity. While this effort is not focused specifically at Centre County, the presence of researchers with such a knowledge base would provide particularly applicable should any incident develop within Penn State's surroundings.
- Centre County has two contracted PEMA certified hazmat teams, Penn State University Hazmat Team and Eagle Towing and Recovery. These teams are essential in response efforts after a hazmat related incident.

Based on assessment results, municipalities in Centre County have moderate to limited administrative and technical staff needed to conduct hazard mitigation-activities. The municipalities vary in staff size, resource availability, fiscal status, service provision, population, overall size, and vulnerability to the profiled hazards. Generally, the municipalities in the northern and western mountainous part of the County and those in the eastern valleys tend to have fewer residents, less staff, and a more limited supply of available resources than those municipalities with higher populations that are located in the central and southern part of the County. Each municipality carries out its own daily operations and provides various community services according to their local needs and limitations. Some of these municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide such services as police protection, fire and emergency medical response, solid waste disposal, recreational opportunities, wastewater treatment, water supply management and infrastructure maintenance. Much of the planning, engineering, and land surveying capabilities

are provided by consulting firms. All municipalities in the County have an identified emergency management coordinator, although some of these coordinators are responsible for more than one jurisdiction.

State agencies can provide technical assistance for mitigation activities. For example, in 2020, PA DOH helped Centre County open a testing site for COVID-19 response and has plans for a secondary site to be used for vaccines once available. PA DOH also assisted County EMA and local police officials with a site assessment. State agencies that can provide hazard assistance include, but are not limited to:

- Pennsylvania Department of Community and Economic Development;
- Pennsylvania Department of Conservation and Natural Resources;
- Pennsylvania Department of Environmental Protection;
- Pennsylvania Department of Health; and
- Pennsylvania Department of Transportation.

Centre County can also partner with Federal agencies for technical assistance on mitigation activities. These agencies include but are not limited to:

- Federal Emergency Management Agency;
- United States Army Corp of Engineers;
- Department of Housing and Urban Development;
- United States Department of Agriculture;
- Economic Development Administration;
- FEMA's Emergency Management Institute;
- United States Environmental Protect Agency; and
- 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, 17 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 Centre 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.

There are also partnering opportunities at the local level. These would include COGs, as with the Centre Region Council of Governments, which represents State College Borough and the townships of College, Ferguson, Halfmoon, Harris, and Patton, and authorities, such as the Spring-Benner-Walker Sewer Authority and the State College Area Municipal Water Authority, among others (CRCG, 2020b).

Support for mitigation planning actions is most often provided by the Commonwealth of Pennsylvania and the Federal Government. Programs that complement Centre 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.
        - In 2019, the Centre County Conservation District was awarded two grants through this program; one for plan development and one for a stream restoration program. The Penns Valley Conservation Association also received a grant to conduct water quality BMPs at Penns Creek Tributaries.
    - 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.

- Funding through this grant had been awarded to Bald Eagle Area School District (2009, 2012, 2013), Bellefonte Area School District (2016), and the Borough of State College (2011, 2015). These have funded projects such as pond restoration, student experiences in forest management, installation of a geo-exchange system, and installation of watershed educational displays (PA DEP, 2020d).

- 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.
  - In 2007, the Centre Area Transportation Authority was awarded $60,000 through this program to purchase dedicated compressed natural gas transit buses. This grant enables municipalities to pursue alternative fuels that might help to reduce greenhouse gas emissions which could combat changing climate conditions.
  - Individuals may be eligible for funding through the Alternative Fuel Vehicle Rebate program administered by the PA DEP. The program provides rebates for individuals when purchasing new, pre-owned, and demonstration vehicles that use alternative fuel sources such as hydrogen fuel cells, compressed natural gas, or battery electric. AFV Rebates have been awarded to several individuals in Centre County.
- 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).
  - In 2020, PennVEST finalized a low-interest loan funding offer for Murmac Farms, LLC, a large-scale dairy and agricultural operation in Centre County. The funding will be used to implement several agricultural BMPs that will dramatically increase water quality in the Nittany Creek and Bald Eagle Cree watersheds.
- 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.
  - Several projects throughout Centre County were funded through this program in 2020. Each project includes a variety of interventions, including stormwater management measures, ADA access, open space

conservation, construction of riparian buffers. Specifically, funds were awarded to Centre Region Parks & Recreation Authority, Ferguson Township, Penn Township, and State College Borough.

- 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.
  - In 2020, several communities were awarded grant funds through this program. Boggs Township will replace damages and undersized stormwater pipes and inlets. Liberty Township will improve the existing sanitary system that flows into the Bald Eagle State Park wastewater treatment plan. Mountaintop Regional Sewer Authority will enhance water production capability during an extended power outage or other emergency event.

- 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.

    The following is a sampling of projects for which FEMA has awarded Hazard Mitigation Assistance Grants in Centre County:
    - State College Borough: Park Forest Middle School post-flood repairs
    - State College Borough: Alpha Fire Company additions
    - Bellefonte Borough: Bellefonte Waste Water Treatment Plant repairs
    - State College Borough: Addition of a catch dam in Walnut Spring Park
    - Bellefonte Borough: Purdue Mountain Road post-flood repairs
    - Addition of a detention pond on public property after severe floods
    - Storm sewer and culvert repairs across Centre County after severe floods
  - 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 CARES Act was passed in Spring 2020 to financially assist communities, businesses, and families through the economic crisis brought on by the COVID-19 pandemic. Funds allocated to the State were passed on to Centre County to open a free COVID-19 test site, provide personal protective equipment (PPE) throughout the County, and allocate grants to educational and non-profit institutions (Centre County, 2020d) . These types of funds only come in response to emergencies. CARES Act funds were allocated as follows:
    - COVID-19 Testing Site: $862,014
    - PPE for emergency responders, local government, health care ,schools, non-profits, and small businesses: $800,000
    - COVID-19 expenses reimbursement for 30 municipalities: $1,421,419
    - Grants for 10 educational institutions: $499,375
    - Grants for 107 non-profit institutions: $864,500
    - Grants for 437 small businesses: $5,536,130
    - Economic Development Support:
        - Chamber of Business & Industry of Centre County: $45,780
        - The Happy Valley Adventure Bureau: $43,400
- 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.
    - In October 2016, a heavy storm caused flash flooding in several parts of Centre County, resulting in damage to over 400 homes and businesses. A Federal Disaster Declaration for public assistance opened federal funding in December 2016. The USDA-NRCS confirmed three sites involving ten landowners were eligible for EWP program funding. The USDA-NRCS provided 75% of project funding and the PA DEP provided the required 25% funding match. All three recovery projects were completed by August 2017.
- 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.
  - In August 2020, the Snow Shoe Volunteer Fire Company in Centre County was awarded an AFG to purchase new self-contained breathing apparatuses (SCBA). The company's existing SCBAs are nearly 15 years and have failed without warning in the past. This grant has been awarded several times in the past. For example, two fire companies were granted funds in 2005 to offer health and safety programs and enhance fire prevention measures.

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.

Reported education and outreach activities in Centre County are summarized as follows:

- Centre County disseminates critical information through CodeRed, a mass notification system. It allows local emergency managers to send out alerts via phone, text, or email in the event of an emergency to residents who sign up for the program.
- Firewise Communities designation is an optional recognition program that empowers neighbors to take action to reduce wildfire risk. It is a five-step, voluntary process that helps communities develop an action plan that minimizes wildfire risk and helps build more safely. Currently, Centre Hall Borough and Miles Township have received Firewise Certification.
- StormReady Certification is an education and outreach program that helps arm communities with the communication and safety skills needed to save lives and property before, during, and after an event. The program is administered by the National Weather Service of the National Oceanic and Atmosphere Administration (NOAA). Centre County completed its enrollment in 2019; all communities are covered under the County Certification. Penn State University is also enrolled in the StormReady program.
- Centre County hosted a Community Rating Systems Workshop facilitated by a FEMA Region III planner during the 2015 HMP planning cycle.

- The Centre County Public Safety Training Center (CCPSTC) is a public safety training facility located in Spring Township. This facility is the result of a regional effort to provide training to police forces, firefighters, emergency services, and hazardous materials workers from across the state. The center includes training opportunities for fire responses with on-site apparatuses, a training tower, and a "burn building". Additionally, the center includes facilities for classroom-based trainings, as well as on-site driving and vehicle trainings. The center provides opportunities for trainees to confront a number of scenarios, including vehicle rescues, situations involving hazardous materials, high angle and confined space rescues, terrorism response, hostage simulation, vehicle operations, and vehicle extrication. While the center is open to any fire company or emergency medical service operation throughout the Commonwealth, the 12 counties expected to take greatest advantage from this center include Bedford, Blair, Cameron, Centre, Clearfield, Clinton, Fulton, Huntingdon, Juniata, Mifflin, Snyder and Union. More than 115 fire departments and nearly 73 emergency medical services organizations service those counties (CCPSTC, 2015).
- The Centre County Community Foundation offers emergency responder scholarships to local training programs. This opportunity increases access for local residents to become involved in emergency response plans and processes.
- Centre County organizes annual household hazardous waste collections events. These are used to educate residents about materials that should not go in waste streams and provides people a responsible place to drop off their materials. This mitigates the risk that households will dump hazardous materials in a way that leads to environmental contamination.
- Centre County Office of Emergency Services provides a variety of guides about hazard mitigation planning and preparedness, including:
    - The Flood Safety preparedness guide was developed in 2015. It describes essential steps to prepare for floods in existing homes and new construction and provides do's and don'ts of responding to flood events.
    - The "All Hazards" School Safety Planning Toolkit was developed by the Commonwealth in 2009. It provides an in-depth outline for planning and preparing for hazards in school facilities.
- The Centre County Heroin and Opioid Prevention and Education (HOPE) Initiative works to eliminate substance abuse, drug overdoses, and drug deaths in the County. This coalition was formally created in 2016, and includes partners from the prevention, treatment, and recovery community; agencies involved in the Criminal Justice System; and members of the community affected by addiction. The HOPE Initiative works to achieve its goals through comprehensive outreach and education programming, in addition to direct support for recovery and treatment options. This coalition regularly attends local events including town hall meetings, local fairs and expos, and events directly related to drug awareness (Centre County, 2020c).

- The Penn State University College of Engineering opened the Penn State Breazeale Reactor (PSBR) in 1955. PSBR staff assisted in the state response to the Three Mile Island (TMI-2) nuclear reactor accident. Immediately following the accident, PSBR staff answered questions about the accident and its affects. In the 1980s, the PSBR, staff developed special training and experiments for operators who would conduct the defueling procedure at the post-accident TMI-2 reactor. In 1990s, Penn State established the Radiation Science and Engineering Center, a university-wide facility to promote research, education, and varied applications of radiation science and nuclear engineering.
- The Centre County Office of Planning and Development adopted the Nittany and Bald Eagle Greenway Plan in 2003, which is an outreach plan to increase public awareness about Spring Creek and Bald Eagle Creek, and their tributaries. This plan calls for undeveloped land to be set aside for recreation or conservation (CCPCDO, 2003b).

5.2.5 Plan Integration

Plan integration ensures that hazard mitigation planning is woven into each municipality's planning and regulatory documents. These include the plans, policies, codes, and programs that guide land use and development. 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).

While not all regulatory tools are relevant to every municipality in Centre County, each municipality should evaluate what tools are available to them related to their vulnerability identified in this HMP. Communities should continue to review and revise building codes, zoning ordinances, floodplain ordinances, and subdivision and land use development ordinances with respect to findings in the 2021 HMP risk assessment. For example, a municipality could revise its zoning ordinance to restrict the density of new development in hazard-prone areas or guide development away from these areas. Some tools may also be useful for addressing multiple hazards in these municipalities; for example, the presence of a stormwater management plan would greatly enhance mitigation capabilities needed to address both flood and transportation hazards.

Comprehensive Plans

As mentioned above, Centre County adopted its Comprehensive Plan in 2003, and is finalizing Phase II, which involves updating existing chapters and creating new chapters of the plan. It is key that the county integrates findings and recommendations from the 2021 HMP Update into the implementation strategies and projects identified in chapters of the comprehensive plan. The planning elements in these documents relate to risks identified in this plan, for example drought, wildfire, and cyber-security. Phase I of the County Comprehensive Plan establishes a set of goals relating to future land use and relates these to recommendations for implementation. One of the County's key goals, as outlined in the Comprehensive Plan, is to preserve its natural resources for the benefit of present and future generations. Specifically, the County aims to balance demands for growth while protecting the County's natural resources,

such as its forested land. As discussed previously, one of the key tools that can be harnessed for managing development identified in a Phase II Implementation Strategy is through zoning and land use regulations. Jurisdictions in Centre County have been successful in managing growth in forested lands through the use of special forest zoning.

The goals, objectives, and recommendations established in Phase I of the Comprehensive Plan and the implementation strategies and opportunities established in Phase II are to some extent related to the hazard mitigation risks and goals established in this HMP. A key opportunity for further integration of hazard mitigation into planning and regulatory tools is to include them in the ongoing Centre County Comprehensive Plan effort through coordination of implementation strategies that help to achieve the established goals and objectives of both plans. These strategies can include adopting or amending ordinances, as described with the special forest zoning above.

CCPCDO is currently developing strategies for implementation using updated information on the physical, social, and economic conditions in the County. As this effort progresses, the HMSC should ensure that the findings of the Risk Assessment and the Mitigation Strategy are shared with CCPCDO. The HMSC will also work to identify actions from the Mitigation Strategy, as well as additional regulatory tools, that can be incorporated into the implementation of the Phase II documents. Such strategies could include utilizing hazard information in the 2021 HMP Update to inform future land use and discourage growth in high-hazard areas.

CCPCDO performs ongoing planning assistance for the local planning regions in Centre County. For example, CCPCDO has worked with the Nittany Valley and Upper Bald Eagle Regions to develop comprehensive plans. CCPCDO should integrate HMP information and materials throughout regional and municipal planning processes such as these. It is recommended that CCPCDO brings HMP information and materials to meetings to share with municipalities. Integrating the discussion of these planning efforts enables better implementation of hazard mitigation strategies. CCPCDO should track all municipal planning efforts in order to integrate hazard mitigation through a variety of plans and regulations. While regional comprehensive plans are developed and updated in the future, communities should consider including hazard mitigation as an element in land use control.

Transportation Plans

The Centre County Long Range Transportation Plan (LRTP) 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 Centre County MPO's process for evaluating the potential impacts of on community and environmental resources. When impacts are unavoidable, CCMPO 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 Transportation Infrastructure Plan (TIP), which is the official list for upcoming planning transportation projects.

Centre County's Recreation and Greenway Plan's goals are to preserve high-quality open space, establish and expand greenway and multi-modal trail systems, increase riparian buffers, and conserve the County's natural resources. The purpose of the plan is to establish specific priorities for conserving open spaces such as farms, forests, community parks, and water bodies and for creating future greenway corridors. The Plan recommends several different approaches that should be pursued by county and local governments, landowners, conservation groups, non-for-profit organizations, and other stakeholders, to protect, conserve, or acquire the recommended conservation lands. Hazard-prone areas identified in the HMP could potentially be identified as suitable areas for conservation or greenways.

Climate Action Plans

Bellefonte recently released its CAP, which sets specific goals and actions to reduce greenhouse gas emissions. Actions from this plan should be integrated into the 2021 HMP Update. For example, retrofitting existing buildings to maximize energy efficiency and reduce emissions. CRPA is currently developing a regional CAAP for the six municipalities in the Centre Region, with the same expressed goals as Bellefonte to reduce greenhouse gas emissions. CRPA should integrate the 2021 HMP Plan mitigation actions to incorporate relevant hazard mitigation actions that also support greenhouse gas reduction and the fight against changing climates.

Ordinances and Codes

Hazard mitigation planning can be integrated into Centre County's Stormwater Management Regulations. The municipalities that are regulated by the County's stormwater management requirements in its SALDO could also opt to develop their own, more stringent stormwater management ordinances. Municipalities can provide recommendations for proper long-term operation and maintenance of stormwater management facilities within the land development subdivision ordinances, work closely with the County to assure that stormwater facilities are maintained over the long-term, and can ensure any hew hydrology studies are adopted upon completion.

Specific language in the Centre County SALDO that relates directly to hazard mitigation is documented below. Whether the County is administering the zoning ordinance for municipalities or the municipality maintains administration, the following guidelines from

Centre County's SALDO can be enforced through the lens of mitigating each municipality's hazards:

- Floodplains should be either maintained in their undeveloped state or be put to uses compatible with the floodplain environment.
- Development should not take place in areas where the soil presents severe engineering or environmental restrictions.
- Future growth patterns should be directed to ensure the protection of municipal and private water supplies. Surface and groundwater quality and flow and recharge must be maintained at levels which are environmentally acceptable.
- The Commission shall, when it deems it necessary for the health, safety, or welfare of the present and future population of the area and necessary for the conservation and protection of local water resources and environmental qualities, prohibit or restrict the Subdivision or Land Development of any portion or portions of the tract which lie within or directly adjacent to the floodplain of any stream or drainage source, unless adequate methods are formulated by the Applicant to solve the problems created by the floodplain environment.
- No Subdivision and/or Land Development, or part thereof, shall be approved if the proposed development and/or improvements will, individually or collectively, increase the regulatory flood elevation.
- The finished elevation of proposed streets shall be no more than two feet below the regulatory flood elevation. The Commission may require, where necessary, profiles and elevations of streets to determine compliance with this requirement.
- All sanitary sewer systems located in flood prone areas, whether public or private, shall be flood-proofed up to a point one foot above the regulatory flood elevation. The Commission may prohibit installation of sewage disposal facilities requiring soil absorption systems where such systems will not function due to high groundwater, flooding, or unsuitable soil characteristics.

Emergency Management

Centre County has a countywide EOP, which was last reviewed in 2018, and all municipalities have a local EOP. Additionally, Penn State University has a Comprehensive Emergency Management Plan (CEMP). These plans embrace an "all-hazards" principle. Most emergency response functions are similar, regardless of the hazard, and the EMC is required to mobilize functions and personnel as required by the emergency. This plan mentions that mitigation opportunities will be considered throughout disaster operations. Implementation includes a combination of conservation tools including land management plans and easements; regulatory methods like density transfers, zoning overlays, buffer zones, and subdivision exactions, and land acquisition made possible through donation and purchase, and purchase of development rights. As these plans are updated, they should incorporate relevant information from the Centre County HMP risk assessment to provide a more detailed overview of potential hazards. These plans should also incorporate long-term mitigation strategies, such as those outlined in this HMP Update, in addition to short-term response and recovery.

Integration Capabilities

Based on the capability assessment results and information from CCPCDO, all of Centre County's jurisdictions have some form of local land use controls. As is discussed in Section 6.1 – Mitigation Strategy Update Process Summary, Centre County upon review of the 2015 mitigation actions, it was determined that the County and several municipalities completed mitigation actions that achieve plan integration by furthering hazard mitigation goals through various land development regulations. Some other land use tools in municipalities have not been updated recently. As municipalities work to update comprehensive plans and land use ordinances, local governments can go further to use land use regulations to direct development away from hazard-prone areas. For example, the ridge zoning overlay that three communities already have in place can be adopted by other municipalities with mapped ridges.

A barrier to plan integration is often the lack of resources to accomplish activities that plan integration requires. Several municipalities noted on the Capability Assessment Surveys that lack of financial resources precludes development of some planning tools. The self-assessment portion of the survey provided each municipality an opportunity to conduct its own self-assessment of its capability to effectively implement hazard mitigation activities. As part of this process, County and municipal officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either "limited," "moderate," or "high." Table 5.2-4 below summaries the results of the self-assessment survey as a percentage of responses received. With available resources being limited and stretched into the foreseeable future, plan integration is extremely relevant and will help leverage existing resources to the maximum extent possible.

Table 5.2-4: Self-Assessment Capability Responses Expressed as a Percentage of Responses Received

CAPABILITY CATEGORY	LIMITED	MODERATE	HIGH
Planning & Regulatory	34%	34%	31%
Administrative & Technical	31%	38%	31%
Financial	38%	34%	28%
Community Political	48%	41%	11%

6. MITIGATION STRATEGY

6.1 MITIGATION STRATEGY UPDATE PROCESS SUMMARY

The Mitigation Strategy serves as the long-term road map to reducing potential losses, vulnerabilities, and shortcomings identified in Section 4 – Risk Assessment. Typically, the Mitigation Strategy includes a list of goals and objectives, with mitigation actions that address those goals and objectives, that are then prioritized based on community needs.

- ✓ Goals are long-term aspirations about the resiliency of the community given the potential effects of hazards.
- ✓ Objectives are measurable strategies that the Centre County community has determined will be necessary to move closer to each goal.
- ✓ Actions are the tasks that are proposed for realizing each objective.

6.1.1 Mitigation Goal and Objective Review

There were five goals and 19 objectives identified in the 2015 HMP. These 2015 goals and objectives were reviewed by the HMSC and HMPT during the Risk Assessment and Mitigation Solutions Meeting held on September 24, 2020 and during a Steering Committee meeting held on October 21, 2020. The review of the 2015 goals and objectives is summarized below in Table 6.1-1. Goals and objectives from the 2015 Plan remain relevant and were largely carried over to the 2021 HMP. Goal 4 was revised to include an emphasis on the need for plan integration.

Table 6.2-1 in Section 6.2 2021 Mitigation Goals and Objectives lists the 2021 mitigation goals and objectives. This table shows that two objectives were added to Goal 1. The first new objective addresses risk around High-Hazard Potential Dams. The second new objective addresses the impacts of changing climates and purposefully overlaps with objectives included in the recent climate action plan efforts. Two objectives were also added to Goal 4 to reflect the County's commitment to plan integration.

Table 6.1-1: Review of Changes to the 2015 HMP Goals and Objectives

GOAL/OBJECTIVE		COMMENTS
Goal 1	Reduce potential injury or death and damage to existing community assets from all hazards.	Continued to 2021 HMP.
Objective 1A	Identify and evaluate potential protection measures for critical facilities, structures, and population with the highest relative vulnerability to all hazards that affect Centre County.	Continued to 2021 HMP.
Objective 1B	Provide public outreach and education regarding property owners' vulnerability to all hazards affecting Centre County and strategies to mitigate the risks from these hazards.	Continued to 2021 HMP.
Objective 1C	Promote the use of applicable insurance programs (i.e., flooding, crop, and fire) in order to reduce impacts of hazards to property owners.	Continued to 2021 HMP.
Objective 1D	Ensure that existing drainage systems such as pipes, culverts, and channels are adequate and functioning properly.	Continued to 2021 HMP.
Objective 1E	Evaluate potential contamination of drinking water sources along transportation corridors.	Continued to 2021 HMP.
Objective 1F	Enhance planning efforts to account for areas of increased transportation accidents.	Continued to 2021 HMP.
Objective 1G	Reduce outage time during significant power failures.	Continued to 2021 HMP.
Goal 2	Ensure new construction and substantially improved construction is resistant to natural hazards.	Continued to 2021 HMP.
Objective 2A	Assess the adequacy of municipal zoning/land-use ordinances and building-code implementation to reduce risk to identified hazards.	Continued to 2021 HMP.
Objective 2B	Encourage and facilitate the development or revision of comprehensive plans and zoning/land-use ordinances to limit development in high-hazard areas.	Continued to 2021 HMP.
Objective 2C	Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.	Continued to 2021 HMP.
Goal 3	Improve emergency warning and response procedures and capabilities.	Continued to 2021 HMP.
Objective 3A	Increase public awareness through public outreach and education of actions to take during an emergency.	Continued to 2021 HMP.

Table 6.1-1: Review of Changes to the 2015 HMP Goals and Objectives

GOAL/OBJECTIVE		COMMENTS
Objective 3B	Enhance response capability of County and municipal fire, police, and emergency medical services personnel to all vulnerable populations.	Continued to 2021 HMP.
Objective 3C	Enhance response capability of County and municipal services by integrating vulnerability analyses into emergency planning efforts.	Continued to 2021 HMP.
Objective 3D	Evaluate communities that require warning systems and storm shelters.	Continued to 2021 HMP.
Objective 3E	Monitor and ensure Emergency Action Plans for all high hazard dams in the County are current.	Continued to 2021 HMP.
Goal 4	Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.	Updated to state "promote hazard mitigation as a public value to be integrated in planning and policy efforts countywide in recognition of its importance to the health, safety, and welfare of the population" to reflect the ongoing importance and commitment to countywide plan integration.
Objective 4A	Provide public education to increase awareness of hazards and opportunities for mitigation.	Continued to 2021 HMP.
Goal 5	Protect existing natural resources and promote the preservation of areas where the natural hazard threat potential is high.	Continued to 2021 HMP.
Objective 5A	Work to preserve steeply sloping areas, sinkhole areas, floodplains, and other natural areas with high threat potential to reduce risk in surrounding populated areas.	Continued to 2021 HMP.
Objective 5B	Protect open space, including parks and wetlands, within the floodplain.	Continued to 2021 HMP.
Objective 5C	Restore degraded natural resources and open space to improve their flood, and other hazard, control function.	Continued to 2021 HMP.

6.1.2 Mitigation Action Review

There were 44 actions identified in the 2015 HMP. Mitigation actions identified and included in the 2015 Plan were distributed after the September 2020 Risk Assessment and Mitigation Solutions Meeting for review and update. Each municipality, the County, and Penn State University were provided with a Mitigation Action Progress Form where communities and stakeholders were asked to indicate the status of each action.

Based on these forms, each 2015 mitigation action has been assigned one of the following categories:

- "Completed" – Actions that were completed since the adopted 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 continual basis by the department.

The majority of existing mitigation actions have been carried over into this 2021 HMP as many actions are continuous or have not yet been completed. A list of the 2015 actions and their status is included in Table 6.1-2. The status of each action was evaluated with the intent of creating a usable mitigation action plan for 2021 with actions and projects that could be completed over the next five years. Appendix C includes responses provided by stakeholders on the Mitigation Action Progress Forms.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
1	Conduct fire prevention inspections, especially in historic properties, annually.	Borough of Bellefonte	Ongoing.
2	Identify and execute the most cost effective floodproofing that will protect Phoenix Avenue business, residential, and critical facility (Bellefonte Emergency Medical Services) properties.	Borough of Bellefonte	Ongoing.
3	Increase current diking level surrounding the wastewater treatment plant.	Borough of Bellefonte	Ongoing.
4	Complete construction of flood wall to protect properties along Spring Creek between High Street and Lamb Street.	Borough of Bellefonte	Ongoing.
5	Continue study of stormwater runoff impacts in flood-prone area of E Street.	Borough of Bellefonte	Ongoing.
6	Obtain grant funding for fire suppression systems and equipment for large, economic anchor, buildings.	Borough of Bellefonte	Ongoing.
7	Identify and execute the most cost-effective floodproofing projects, including buying properties in the floodplain and other structural or infrastructural improvements, that will effectively protect floodplain properties in the Borough of Milesburg.	Borough of Milesburg	Ongoing.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
8	Move vulnerable section of Borough's main waterline near State Route 445 and Elk Creek.	Borough of Millheim	Ongoing. The waterline along 445 and Elk Creek has been upgraded. Now the most vulnerable part of the waterline is from the reservoir to 445, this is about 2,000 feet of line that needs to be replaced.
9	Complete Cold Stream Dam reconstruction project.	Borough of Philipsburg	Completed.
10	Continue to restrict future development at sites within the floodplain in Ferguson Township.	Township of Ferguson	Ongoing.
11	Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Spring Mills.	Township of Gregg	Ongoing. Riparian buffer and Conservation Reserve Enhancement Program (CREP) plantings upstream.
12	Provide public education and resources for identifying and reporting sinkholes and subsidence areas.	Township of Haines	Ongoing. Still provide the public upon request with DEP fact sheets on sinkholes and DCNR maps of karst density in Centre County. We continue to monitor known areas of subsidence and/or sinkholes that could affect our road system. Notify DEP if new sites are found.
13	Extend storm drain system up Sierra Lane in Park Forest neighborhood with numerous inlets.	Township of Patton	Completed.
14	Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Coburn.	Township of Penn	Deferred.
15	Replace deteriorated section of water line.	Township of Penn	Completed. Replacement of new water lines was completed in 2018.
16	Complete development and implementation of source water protection plan to prevent unfiltered chemicals from entering Tussey sinkhole and ground water supply along US Route 322.	Township of Potter	Ongoing. Under further investigation.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
17	Continue to provide homeowners and developers advice on Karst topography when developing in known sinkhole prone areas.	Centre County; Borough of Bellefonte, Township of Benner, Township of Boggs, Township of Burnside, Borough of Centre Hall, Township of College, Township of Curtin, Township of Ferguson, Township of Gregg, Township of Haines, Township of Halfmoon, Township of Harris, Borough of Howard, Township of Howard, Township of Huston, Township of Liberty, Township of Marion, Township of Miles, Borough of Milesburg, Borough of Millheim, Township of Patton, Township of Penn, Borough of Philipsburg, Borough of Port Matilda, Township of Potter, Township of Rush, Township of Snow Shoe, Township of Spring, Borough of State College, Township of Taylor, Township of Union, Borough of Unionville, Township of Walker, Township of Worth	Ongoing. Update action to clarify that any advice provided on corrective actions is based on accepted methodology and engineering models. Centre County and municipalities provide information during development applications. Municipalities update the County when additional subsidence incidents occur. Benner Township is specifically monitoring Purdue Mt. Road for additional subsidence. Completed in Miles Township. Cancelled in Boggs Township because there is no known Karst topography.
18	Participate in the development and continued update of Emergency Action Plans.	Centre County; Township of Benner, Township of College, Township of Penn, Township of Liberty, Township of Rush	Ongoing. Centre County OES Staff are involved with plan development and plan updates when they are due.
19	Provide fire safety education program.	Borough of Bellefonte, Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	Ongoing. Centre Region Fire Protection program hired staff person responsible for public education. Boalsburg Fire Company provides annual Fire Safety education events in Harris Township. Fire Safety Programs in Halfmoon Township are provided by Port Matilda Fire Company.
20	Acquire additional generators for shelter locations.	Township of College, Township of Halfmoon	Completed for Halfmoon Township, which purchased and installed a generator at Halfmoon Christian Fellowship Church..
21	Continue to coordinate with PA State Game Commission and DCNR to conduct prescribed burns as necessary to reduce wildfire risk.	Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	Ongoing. The PA Game Commission conducted numerous grassland burns in neighboring Township of Benner. The PA Game Commission and DCNR have not conducted prescribed burns since 2018 due to weather and COVID-19. DCNR has not conducted prescribed fires in Harris Township since the 2015 Plan.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
22	Continue to identify point of dispensing sites.	Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	Ongoing. Centre Region Office of Emergency Management deferred to Centre County OES and PA DOH as the lead agencies. Penn State University noted to add the State College Health Department as a lead agency on the action.
23	Identify vulnerable populations, especially in independent living, extended care, and hospice care residential living facilities, to provide information regarding appropriate evacuation and sheltering resources.	Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, State College Borough	Completed. 2016 Centre Region EM summer intern updated Centre Region EOP.
24	Provide information to private land owners about benefits of and obtaining crop insurance for drought protection.	Township of Potter, Township of Ferguson, Township of Halfmoon, Township of Spring, Township of Gregg, Township of Marion, Township of Walker, Township of College, Township of Liberty, Township of Harris, Township of Miles	Ongoing. Completed in Miles Township.
25	Expand participation in the Firewise Program.	Township of Rush, Township of Gregg, Township of Snow Shoe, Township of Walker, Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	Ongoing.
26	Continue participation in Centre County Task Force to coordinate issues on deep gas drilling, economics, and water quality.	Township of Rush, Township of Taylor, Township of Worth, Township of Huston, Township of Union, Township of Snow Shoe, Township of Burnside, Township of Boggs, Township of Curtin, Township of Howard, Township of Liberty, Borough of Philipsburg, Borough of Port Matilda, Borough of Unionville, Borough of Snow Shoe, Borough of Howard	Ongoing.
27	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.	Centre County	Ongoing. The County received a training on CRS from FEMA Region 3 in 2015. Capacity to administer this program at the community level remains limited. The County recognizes the benefits of CRS participation, and is interested in exploring opportunities to minimize the administrative barriers of entry into the program.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
28	Coordinate the performance of detailed flood studies for the County's high-hazard areas to determine a full range of flood-recurrence intervals for use in future vulnerability analyses.	Centre County	Ongoing.
29	Obtain from PEMA Bureau of Recovery and Mitigation listings of repetitive loss properties within Centre County and distribute to municipal elected officials and managers.	Centre County	Ongoing.
30	Secure state or grant funding to update and adopt Act 167 Stormwater Management Plan.	Centre County	Ongoing
31	Coordinate construction projects and winter storm response plans.	Centre County	Ongoing. Revise action to indicate that the lead agency is Centre County OES in coordination with CCMPO, PennDOT, and Pennsylvania State Police.
32	Maintain StormReady County status.	Centre County	Ongoing. Since the 2015 HMP Update, this was renewed in 2016 and 2019. Next renewal is scheduled for 2022.
33	Continue participation in and encourage continued participation by municipality first responders in South Central Mountains Regional Task Force (SCMRTF).	Centre County	Ongoing. Centre County OES staff attend bimonthly first responder meetings and shares information about the SCMRTF. First responder agencies participate in SCMRTF-sponsored trainings and exercises. They also actively participate on subcommittees of the SCMRTF.
34	Coordinate with state and federal agencies on potential mitigation actions for terrorist activities.	Centre County	Ongoing.
35	Assist with coordination between County residents and utility companies on critical outage events.	Centre County	Ongoing. Centre County OES Staff frequently receive information from utilities during outages which can be shared with residents. Annual emergency preparation meetings are held with utilities.
36	Enhance the participation on the County Hazard Mitigation Steering Committee.	Centre County	Ongoing.

Table 6.1-2: Five-Year Mitigation Plan Action Review

2015 HMP ACTION		MUNICIPALITY	2021 HMP REVIEW COMMENTS
37	Integrate hazard mitigation goals and objectives into County Phase II comprehensive planning efforts by ensuring mitigation is part of implementation of each planning area chapter.	Centre County	Completed. Phase II of the County's comprehensive planning effort is largely complete and integrates mitigation in applicable chapters including historic preservation, community facilities, and public safety.
38	Integrate hazard mitigation goals and objectives into County Phase II comprehensive planning efforts by developing a Hazard Mitigation Implementation Strategy chapter.	Centre County	Ongoing.
39	Identify water suppliers that are at greater risk to effects from drought and determine if they are candidates for interconnections from area suppliers.	Centre County	Ongoing.
40	Provide alternate power sources for each new or remodeled building on University Park Campus which provides essential functions.	Penn State University	Ongoing process. Since the 2015 HMP, the University has evaluated current status and identified key resources that needed alternate power supplies, and alternate power was included in the upgrades to the WWTP. The Office of Physical Plant identified the need to update the criteria used for determining whether a building needed an alternate power source. This is an ongoing process and each major upgrade to a building is evaluated.
41	Continue development and updates of Game Action Plans, to detail response to address post-game disturbances at Penn State.	Penn State University; Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	Ongoing. The University continues to update this process. Some portions of the plan have been completed while others need continual update due to changes in partnerships and organizational structure. ICAPS (Intercollegiate Athletics Public Safety) planning group met monthly prior to COVID-19. Activity will resume after COVID-19 restrictions.
42	Obtain and compile updated Department of Environmental Protection inundation data and Emergency Action Plan vulnerability data as it becomes available to inform plan update.	Centre County	Ongoing.

Table 6.1-2: Five-Year Mitigation Plan Action Review

	2015 HMP ACTION	MUNICIPALITY	2021 HMP REVIEW COMMENTS
43	Obtain grant funding to acquire, demolish, relocate, and/or elevate structures that are vulnerable to flooding.	Centre County; Bellefonte Borough, Benner Township, Boggs Township, Burnside Township, Centre Hall Borough, College Township, Curtin Township, Ferguson Township, Gregg Township, Haines Township, Halfmoon Township, Harris Township, Howard Borough, Howard Township, Huston Township, Liberty Township, Marion Township, Miles Township, Milesburg Borough, Millheim Borough, Patton Township, Penn Township, Philipsburg Borough, Port Matilda Borough, Potter Township, Rush Township, Snow Shoe Borough, Snow Shoe Township, Spring Township, State College Borough, Taylor Township, Union Township, Unionville Borough, Walker Township, Worth Township	Ongoing. Remove Centre Region Office of Emergency Management and the lead agency/department, and replace with Centre County Office of Emergency Services in coordination with municipalities. No structures were identified in College Township, Halfmoon Township, Harris Township, Patton Township, Snow Shoe Borough, or State College Borough, but these communities will continue to monitor conditions. Cancelled for Miles and Burnside Townships and marked completed by Centre Hall Borough, which notes that there are not structures within the SFHA in the Borough. This action will be updated to include demolition/reconstruction.
44	Review floodplain ordinances annually to ensure compliance with current floodplain management and insurance standards and guidance.	Bellefonte Borough, Benner Township, Boggs Township, Burnside Township, Centre Hall Borough, College Township, Curtin Township, Ferguson Township, Gregg Township, Haines Township, Halfmoon Township, Harris Township, Howard Borough, Howard Township, Huston Township, Liberty Township, Marion Township, Miles Township, Milesburg Borough, Millheim Borough, Patton Township, Penn Township, Philipsburg Borough, Port Matilda Borough, Potter Township, Rush Township, Snow Shoe Borough, Snow Shoe Township, Spring Township, State College Borough, Taylor Township, Union Township, Unionville Borough, Walker Township, Worth Township	Ongoing. Haines Township utilizes County GIS mapping, FIRM and FIS to confirm flood prone areas when reviewing zoning and building applications, and encourages avoidance of construction in flood prone or high-risk areas within the Township. Union Township was in the process of review during this HMP Update. Deferred in Snow Shoe Borough; flooding is insignificant, so review happens less frequently than an annual basis. Completed for Centre Hall Borough and Miles Township. Centre Hall Borough notes that there are not structures within the SFHA in the Borough.

6.1.3 Mitigation Successes

A wide variety of progress has been made on hazard mitigation projects and actions within the last five years. Details on actions marked as "completed" or "ongoing" are summarized below:

Flood Mitigation Successes

- Ferguson Township restricts new development within the Floodplain and will continue this practice going forwards.

- Gregg Township made progress on an ongoing action to identify and execute the most cost-effective floodwater mitigation projects in and around the flood-prone community of the Village of Spring Mills. A riparian buffer was installed with additional plantings upstream of the Village of Spring Mills through the Conservation Reserve Enhancement Program (CREP) administered by the Farm Service Agency. Gregg Township plans to implement additional flood mitigation projects.
- Millheim Borough replaced portions of the most vulnerable parts of the municipalities' waterline. The section along SR 445 and Elk Creek was upgraded. The action is ongoing as about 2,000 feet still need to be replaced to mitigate flood concerns.
- Patton Township completed an extension project on the storm drain system on Sierra Lane in the Park Forest neighborhood, which will provide needed drainage to avoid flood concerns.
- Penn Township replaced deteriorated sections of the water line in 2018 to mitigate flood hazards.
- Philipsburg Borough completed reconstruction of the Cold Stream Dam which will effectively mitigate flood concerns from potential dam failure.

Wildfire and Urban Fire Mitigation Successes

- The Centre Region Council of Governments provides a Fire Safety Program to Patton Borough, Harris Borough, College Township, Ferguson Township, State College Borough, and Bellefonte Borough. Services provided through this program that relate to the mitigation of fire hazards include: inspection of all commercial properties to ensure compliance with the International Fire Code; review of building plans and inspections of fire protection systems being installed in existing building; public education regarding fire safety to schools, fraternities, and civic groups; and assistance to the Centre Region Fire Marshall in the investigation of fires to determine if code violations contributed to the fire, or if code improvements helped minimize the severity of the fire.
- Centre County continues to coordinate prescribed burns with the PA Game Commission and the PA Department of Conservation and Natural Resources (DCNR). Controlled or prescribed burning is a forest management technique that helps to reduce fuel buildup and decreases the likelihood of more serious, hotter fires in the future. Prescribed burning can also help to control invasive plant specifies and reduce deer tick populations. Weather conditions and COVID complications have kept the DCNR from performing any prescribed burns since the 2015 HMP. However, there are plans to implement this action in the future when conditions permit it to occur safely.

Subsidence and Sinkhole Mitigation Successes

- Haines Township continues to monitor known areas of subsidence and sinkholes that could affect the road system. The PA DEP is notified whenever new sites are found. The

municipality also offers ongoing information and guidance to the public about sinkholes and karst density in Centre County.

- Potter Township is doing ongoing investigations into the Tussey sinkhole and ground water supply along US Route 322. There are plans to complete and implement a source water protection plan to prevent chemicals entering the water supply.
- Centre County has continued to provide homeowners and developers with advice on Karst topography when developing in known sinkhole prone areas. The County has incorporated this into the Comprehensive Plan and its Subdivision and Land Development Ordinance (SALDO) review process. This is also an ongoing effort in municipalities with Karst topography throughout the county. For example, Centre Hall recommends that homeowners consult an engineer before building in sinkhole prone areas, while Patton Township, Potter Township, and State College Borough provide information to landowners through their planning offices.

Planning and Regulatory Successes

- In 2016, the Centre Region Emergency Management Agency was able to update the Centre Region Emergency Operations Plan.
- Since 2015, CCPCDO has largely completed Phase II of the County's comprehensive planning effort. Updates and additions through Phase II integrate mitigation through historic preservation, community facilities, and public safety.
- Before COVID-19 complications, the Intercollegiate Athletics Public Safety planning group met monthly to continue development and implementation of Game Action Plans, which detail response measures for civil disturbances after Penn State University sports games. Monthly meetings will resume when it is safe to meet in person.

Emergency Response Successes

- Halfmoon Township purchased and installed a backup generator at the Halfmoon Christian Fellowship Church, adding an additional emergency shelter to the community's profile in the event of strong storms and utility interruption.
- Centre Region Fire Protection program hired a staff person responsible for public education on fire safety.
- Centre County and Penn State University have maintained their StormReady statuses since 2015. Program requirements include establishments of a 24-hour warning point and emergency operations center, multiple ways to receive severe weather warnings and public alerts, create a system to monitor local weather conditions, promote the importance of public readiness through community seminars, and develop a formal hazardous weather plan that includes training severe weather spotters and holding emergency exercises. Centre County offers annual presentations on the StormReady Program through emergency management coordinator trainings.

6.2 2021 MITIGATION GOALS AND OBJECTIVES

Based on the review of the 2015 HMP goals and objectives, a new set of goals and objectives were developed in 2021. Table 6.2-1 below lists the updated mitigation goals and objectives established for the 2021 Plan Update. As previously indicated, two new objectives were added to Goal 1 and two new objectives were also added to Goal 4. There are 5 goals and 23 objectives identified.

Table 6.2-1: 2021 Mitigation Goals and Objectives

Goal 1	Reduce potential injury or death and damage to existing community assets from all hazards.
Objective 1A	Identify and evaluate potential protection measures for critical facilities, structures, and population with the highest relative vulnerability to all hazards that affect Centre County.
Objective 1B	Provide public outreach and education regarding property owners' vulnerability to all hazards affecting Centre County and strategies to mitigate the risks from these hazards.
Objective 1C	Promote the use of applicable insurance programs (i.e., flooding, crop, and fire) in order to reduce impacts of hazards to property owners.
Objective 1D	Ensure that existing drainage systems such as pipes, culverts, and channels are adequate and functioning properly.
Objective 1E	Evaluate potential contamination of drinking water sources along transportation corridors.
Objective 1F	Enhance planning efforts to account for areas of increased transportation accidents.
Objective 1G	Reduce outage time during significant power failures.
Objective 1H	Evaluate potential climate-related risks, and mitigate these risks while preparing communities for chronic and extreme weather events.
Objective 1I	Coordinate with High-Hazard Potential Dam owners and affected officials on dam rehabilitation and funding.
Goal 2	Ensure new construction and substantially improved construction is resistant to natural hazards.
Objective 2A	Assess the adequacy of municipal zoning/land-use ordinances and building-code implementation to reduce risk to identified hazards.
Objective 2B	Encourage and facilitate the development or revision of comprehensive plans and zoning/land-use ordinances to limit development in high-hazard areas.
Objective 2C	Provide adequate and consistent enforcement of ordinances and codes within and between jurisdictions.
Goal 3	Improve emergency warning and response procedures and capabilities.
Objective 3A	Increase public awareness through public outreach and education of actions to take during an emergency.

Objective 3B	Enhance response capability of County and municipal fire, police, and emergency medical services personnel to all vulnerable populations.
Objective 3C	Enhance response capability of County and municipal services by integrating vulnerability analyses into emergency planning efforts.
Objective 3D	Evaluate communities that require warning systems and storm shelters.
Objective 3E	Monitor and ensure Emergency Action Plans for all high hazard dams in the County are current.
Goal 4	Promote hazard mitigation as a public value to be integrated in planning and policy efforts countywide in recognition of its importance to the health, safety, and welfare of the population.
Objective 4A	Provide public education to increase awareness of hazards and opportunities for mitigation.
Objective 4B	Promote partnerships between various County departments and communities to continue to develop a countywide approach to identifying and implementing mitigation actions.
Objective 4C	Seek opportunities to integrate hazard mitigation efforts with other planning initiatives throughout the County.
Goal 5	Protect existing natural resources, and promote the preservation of areas where the natural hazard threat potential is high.
Objective 5A	Work to preserve steeply sloping areas, sinkhole areas, floodplains, and other natural areas with high threat potential to reduce risk in surrounding populated areas.
Objective 5B	Protect open space, including parks and wetlands, within the floodplain.
Objective 5C	Restore degraded natural resources and open space to improve their flood, and other hazard, control function.

6.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

The Mitigation Strategy in the updated HMP should include analysis of a comprehensive range of specific techniques or actions. FEMA, through the March 2013 Local Mitigation Handbook, and PEMA, through the 2020 Standard Operating Guide, 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 the 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.

Table 6.3-1 provides a matrix identifying the mitigation techniques used for the hazards identified in the Risk Assessment. The specific actions associated with these techniques are included in Table 6.4-1 in the next section.

Table 6.3-1: Mitigation Techniques for All Hazards in Centre County

HAZARD *(in order of Risk Factor ranking)*	MITIGATION TECHNIQUE			
	PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS
Winter Storm (N)	X	X		X
Flood, Flash Flood, Ice Jam (N)	X	X	X	X
Pandemic and Infectious Disease (N)	X	X		X
Drought (N)	X	X		X
Tornado, Windstorm (N)	X	X		X
Environmental Hazards (EH) - Hazardous Materials Release (M)	X	X	X	X
Opioid Addiction (M)	X			X
Hurricane, Tropical Storm, Nor'easter (N)	X	X	X	X
Terrorism (M)	X			X
Utility Interruption (M)	X	X		X
Subsidence, Sinkhole (N)	X			X
EH - Conventional Oil and Gas Wells (M)	X			X
EH - Unconventional Oil and Gas (M)	X			X
Transportation Accidents (M)	X	X		X
Dam Failure (M)	X	X		X
Wildfire (N)	X	X	X	X
Cyber Terrorism (M)	X	X		X
Nuclear Incidents (M)	X			X
Civil Disturbance (M)	X			X

Table 6.3-1: Mitigation Techniques for All Hazards in Centre County

HAZARD *(in order of Risk Factor ranking)*	MITIGATION TECHNIQUE			
	PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS
Landslide (N)	X			X
Earthquake (N)	X			X
Radon Exposure (N)	X			X
Extreme Temperature (N)	X			X
Urban Fire and Explosion (M)	X	X		X
Lightning Strike (N)	X			X

6.4 MITIGATION ACTION PLAN

Mitigation actions have been carried over from the 2015 Plan and developed for the County and participating jurisdictions. While some actions are more general in nature and could apply to more than one jurisdiction, other actions are specific to individual projects or jurisdictions. Mitigation actions were developed based on the following: issues identified in the Risk Assessment, gaps identified in the mitigation capability analysis, input from HMSC, and feedback from the HMPT.

During the Risk Assessment and Mitigation Solutions Workshop on September 24, 2020, mitigation techniques were discussed using FEMA's Mitigation Ideas document. After the meeting, municipalities were provided their Mitigation Action Progress 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, each participating jurisdiction was given New Mitigation Action Forms to provide any new actions or projects to be included in the plan update. New Mitigation Action Forms were also posted to the project website and set 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 actions in the 2021 Plan if they so wished.

The final list of 60 mitigation actions is described in Table 6.4-1 below. 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 the table, 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 Centre County. More than one action is identified for several hazards. Every participating jurisdiction has at least one mitigation action.

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.

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 1	Conduct fire prevention inspections, especially in historic properties, annually.
COMMUNITY: Borough of Bellefonte	
Category:	Education and Awareness
Hazard(s) Addressed:	Urban Fire
Lead Agency/Department:	Borough of Bellefonte
Implementation Schedule:	Annually
Funding Source:	Borough, HMGP
ACTION NO: 2	Identify and execute the most cost effective floodproofing that will protect Phoenix Avenue business, residential, and critical facility (Bellefonte Emergency Medical Services) properties.
COMMUNITY: Borough of Bellefonte	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Borough of Bellefonte
Implementation Schedule:	Five years
Funding Source:	County, DCED, HMGP
ACTION NO: 3	Increase current diking level surrounding the wastewater treatment plant.
COMMUNITY: Borough of Bellefonte	
Category:	Natural Systems Protection; Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Borough of Bellefonte
Implementation Schedule:	Five years
Funding Source:	CPLP, County, DEP, HMGP
ACTION NO: 4	Complete construction of flood wall to protect properties along Spring Creek between High Street and Lamb Street.
COMMUNITY: Borough of Bellefonte	
Category:	Natural Systems Protection; Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Borough of Bellefonte; Bellefonte Area of Individual Development Authority
Implementation Schedule:	One year
Funding Source:	County, DCED, HMGP

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 5	**Continue study of stormwater runoff impacts in flood-prone area of E Street.**
COMMUNITY: Borough of Bellefonte	
Category:	Natural Systems Protection; Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Borough of Bellefonte
Implementation Schedule:	Five years
Funding Source:	CPLP, County, PA DEP, HMGP
ACTION NO: 6	**Obtain grant funding for fire suppression systems and equipment for large, economic anchor, buildings.**
COMMUNITY: Borough of Bellefonte	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Urban Fire
Lead Agency/Department:	Borough of Bellefonte; Bellefonte Keystone Community Development Association
Implementation Schedule:	Two years
Funding Source:	DCED
ACTION NO: 7	**Identify and execute the most cost effective floodproofing projects, including buying properties in the floodplain and other structural or infrastructural improvements, that will effectively protect floodplain properties in the Borough of Milesburg.**
COMMUNITY: Borough of Milesburg	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Borough of Milesburg
Implementation Schedule:	Five years
Funding Source:	County, DCED, HMGP
ACTION NO: 8	**Move vulnerable section of Borough's main waterline near State Route 445 and Elk Creek.**
COMMUNITY: Borough of Millheim	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Transportation Accidents
Lead Agency/Department:	Borough of Millheim
Implementation Schedule:	Three years
Funding Source:	CDBG, HMGP, Borough of Millheim

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 9	**Continue to restrict future development at sites within the floodplain in Ferguson Township.**
COMMUNITY: Township of Ferguson	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre Region Council of Governments
Implementation Schedule:	Five years
Funding Source:	County, HMGP
ACTION NO: 10	**Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Spring Mills.**
COMMUNITY: Township of Gregg	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Township of Gregg
Implementation Schedule:	Five years
Funding Source:	County, DCED, HMGP
ACTION NO: 11	**Provide public education and resources for identifying and reporting sinkholes and subsidence areas.**
COMMUNITY: Township of Haines	
Category:	Education and Awareness
Hazard(s) Addressed:	Subsidence, Sinkhole
Lead Agency/Department:	Township of Haines
Implementation Schedule:	Two years
Funding Source:	Township, HMGP
ACTION NO: 12	**Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Coburn.**
COMMUNITY: Township of Penn	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Township of Penn
Implementation Schedule:	Five years
Funding Source:	County, DCED, HMGP

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 13	**Complete development and implementation of source water protection plan to prevent unfiltered chemicals from entering Tussey sinkhole and ground water supply along US Route 322.**
COMMUNITY: Township of Potter	
Category:	Plans and Regulations
Hazard(s) Addressed:	Transportation Accidents; Environmental Hazards - Hazardous Materials Release, Conventional Oil and Gas Wells, Unconventional Oil and Gas Wells
Lead Agency/Department:	Township of Potter
Implementation Schedule:	Five years
Funding Source:	PennDOT
ACTION NO: 14	**Continue to provide homeowners and developers advice on Karst topography when developing in known sinkhole prone areas. Advice provided on corrective actions is based on accepted methodology and engineering models.**
COMMUNITY: Centre County; Borough of Bellefonte, Township of Benner, Township of Burnside, Borough of Centre Hall, Township of College, Township of Curtin, Township of Ferguson, Township of Gregg, Township of Haines, Township of Halfmoon, Township of Harris, Borough of Howard, Township of Howard, Township of Huston, Township of Liberty, Township of Marion, Borough of Milesburg, Borough of Millheim, Township of Patton, Township of Penn, Borough of Port Matilda, Township of Potter, Township of Rush, Township of Snow Shoe, Township of Spring, Borough of State College, Township of Taylor, Township of Union, Borough of Unionville, Township of Walker, Township of Worth	
Category:	Education and Awareness
Hazard(s) Addressed:	Subsidence, Sinkhole
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 15	**Participate in the development and continued update of Emergency Action Plans.**
COMMUNITY: Centre County; Township of Benner, Township of College, Township of Penn, Township of Liberty, Township of Rush	
Category:	Plans and Regulations
Hazard(s) Addressed:	Dam Failure
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	DCNR

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 16	Provide fire safety education program.
COMMUNITY: Borough of Bellefonte, Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Education and Awareness
Hazard(s) Addressed:	Urban Fire
Lead Agency/Department:	Municipalities and Centre Region
Implementation Schedule:	Annually
Funding Source:	DCNR, HMGP
ACTION NO: 17	Acquire additional generators for shelter locations.
COMMUNITY: Township of College	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Winter Storm; Utility Interruption; Hurricane, Tropical Storm, Nor'easter; Tornado, Windstorm
Lead Agency/Department:	Centre Region Office of Emergency Management
Implementation Schedule:	Five years
Funding Source:	County, HMGP
ACTION NO: 18	Continue to coordinate with PA State Game Commission and DCNR to conduct prescribed burns as necessary to reduce wildfire risk.
COMMUNITY: Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Natural Systems Protection
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Centre Region Office of Emergency Management
Implementation Schedule:	Five years
Funding Source:	DCNR
ACTION NO: 19	Continue to identify point of dispensing sites.
COMMUNITY: Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Plans and Regulations
Hazard(s) Addressed:	Pandemic and Infectious Disease
Lead Agency/Department:	Centre Region Office of Emergency Management
Implementation Schedule:	Ongoing
Funding Source:	HMGP

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 20	Provide information to private land owners about benefits of and obtaining crop insurance for drought protection.
COMMUNITY: Township of Potter, Township of Ferguson, Township of Halfmoon, Township of Spring, Township of Gregg, Township of Marion, Township of Walker, Township of College, Township of Liberty, Township of Harris	
Category:	Education and Awareness
Hazard(s) Addressed:	Drought
Lead Agency/Department:	Penn State University – Cooperative Extension
Implementation Schedule:	Two years
Funding Source:	Municipalities
ACTION NO: 21	Expand participation in the Firewise Program.
COMMUNITY: Township of Rush, Township of Gregg, Township of Snow Shoe, Township of Walker, Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Education and Awareness
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Bureau of Forestry
Implementation Schedule:	Five years
Funding Source:	County, DCNR, HMGP
ACTION NO: 22	Continue participation in Centre County Task Force to coordinate issues on deep gas drilling, economics, and water quality.
COMMUNITY: Township of Rush, Township of Taylor, Township of Worth, Township of Huston, Township of Union, Township of Snow Shoe, Township of Burnside, Township of Boggs, Township of Curtin, Township of Howard, Township of Liberty, Borough of Philipsburg Borough of Port Matilda, Borough of Unionville, Borough of Snow Shoe, Borough of Howard	
Category:	Education and Awareness
Hazard(s) Addressed:	Environmental Hazards - Conventional Oil and Gas Wells, Unconventional Oil and Gas Wells; Transportation Accidents
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 23	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Two years
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 24	**Coordinate the performance of detailed flood studies for the County's high-hazard areas to determine a full range of flood-recurrence intervals for use in future vulnerability analyses.**
COMMUNITY: Centre County	
Category:	Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Five years
Funding Source:	County
ACTION NO: 25	**Obtain from PEMA Bureau of Recovery and Mitigation listings of repetitive loss properties within Centre County and distribute to municipal elected officials and managers.**
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 26	**Secure state or grant funding to update and adopt Act 167 Stormwater Management Plan.**
COMMUNITY: Centre County	
Category:	Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Two years
Funding Source:	PA DEP
ACTION NO: 27	**Coordinate construction projects and winter storm response plans.**
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Winter Storm; Transportation Accidents
Lead Agency/Department:	PennDOT District #2 in coordination with Centre County OES, CCMPO, and Pennsylvania State Police
Implementation Schedule:	Ongoing
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 28	Maintain StormReady County status.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Tornado, Windstorm; Hurricane, Tropical Storm, Nor'easter; Lightning Strike
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County, PEMA
ACTION NO: 29	Continue participation in and encourage continued participation by municipality first responders in South Central Mountains Regional Task Force.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Terrorism
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 30	Coordinate with state and federal agencies on potential mitigation actions for terrorist activities.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Terrorism
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	HMGP
ACTION NO: 31	Assist with coordination between County residents and utility companies on critical outage events.
COMMUNITY: Centre County	
Category:	Plans and Regulations
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 32	Enhance the participation on the County Hazard Mitigation Steering Committee.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	All
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	One year
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 33	**Integrate hazard mitigation goals and objectives into County Phase II comprehensive planning efforts by developing a Hazard Mitigation Implementation Strategy chapter.**
COMMUNITY: Centre County	
Category:	Plans and Regulations
Hazard(s) Addressed:	All
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Three years
Funding Source:	County
ACTION NO: 34	**Identify water suppliers that are at greater risk to effects from drought and determine if they are candidates for interconnections from area suppliers.**
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Drought
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Five years
Funding Source:	HMGP, DCNR
ACTION NO: 35	**Provide alternate power sources for each new or remodeled building on University Park Campus which provides essential functions.**
COMMUNITY: Penn State University	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Penn State University Office of Physical Plant
Implementation Schedule:	Ongoing
Funding Source:	Penn State University capital funds
ACTION NO: 36	**Continue development and updates of Game Action Plans, to detail response to address post-game disturbances at Penn State.**
COMMUNITY: Penn State University, Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Plans and Regulations
Hazard(s) Addressed:	Civil Disturbance
Lead Agency/Department:	Penn State University Emergency Management; Centre Region Office of Emergency Management
Implementation Schedule:	Annually
Funding Source:	County, HMGP

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 37	Obtain and compile updated Department of Environmental Protection inundation data and Emergency Action Plan vulnerability data as it becomes available to inform plan update.
COMMUNITY: Centre County	
Category:	Plans and Regulations
Hazard(s) Addressed:	Dam Failure
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 38	Obtain grant funding for the acquisition, demolition, demolition/reconstruction, relocation, and/or elevation of structures that are vulnerable to flooding.
COMMUNITY: Centre County, Bellefonte Borough, Benner Township, Boggs Township, College Township, Curtin Township, Ferguson Township, Gregg Township, Haines Township, Halfmoon Township, Harris Township, Howard Borough, Howard Township, Huston Township, Liberty Township, Marion Township, Milesburg Borough, Millheim Borough, Patton Township, Penn Township, Philipsburg Borough, Port Matilda Borough, Potter Township, Rush Township, Snow Shoe Borough, Snow Shoe Township, Spring Township, State College Borough, Taylor Township, Union Township, Unionville Borough, Walker Township, and Worth Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre County Office of Emergency Services in coordination with municipalities
Implementation Schedule:	Five years
Funding Source:	HMGP
ACTION NO: 39	Review floodplain ordinances annually to ensure compliance with current floodplain management and insurance standards and guidance.
COMMUNITY: Bellefonte Borough, Benner Township, Boggs Township, Burnside Township, College Township, Curtin Township, Ferguson Township, Gregg Township, Haines Township, Halfmoon Township, Harris Township, Howard Borough, Howard Township, Huston Township, Liberty Township, Marion Township, Milesburg Borough, Millheim Borough, Patton Township, Penn Township, Philipsburg Borough, Port Matilda Borough, Potter Township, Rush Township, Snow Shoe Township, Spring Township, State College Borough, Taylor Township, Union Township, Unionville Borough, Walker Township, Worth Township	
Category:	Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre Region Office of Emergency Management; Centre County Planning and Community Development Office; Municipalities
Implementation Schedule:	Annually
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 40	**Develop a Centre Region Taskforce to complete a detailed After Action Report and Improvement Plan (IP) for COVID-19. The taskforce will meet regularly to ensure implementation of the IP and plan for other infectious disease issues in the Centre Region.**
COMMUNITY: Township of College, Township of Ferguson, Township of Halfmoon, Township of Harris, Township of Patton, Borough of State College	
Category:	Plans and Regulations
Hazard(s) Addressed:	Pandemic and Infectious Disease
Lead Agency/Department:	Centre Region Office of Emergency Management and Penn State University Health Services
Implementation Schedule:	Ongoing
Funding Source:	Municipalities, Penn State University, State College Area School District , and Local Businesses
ACTION NO: 41	**Expand wildfire training to first responders, increase outreach to local officials to explain risks, and use the fire department to include wildfire awareness in their school educational program.**
COMMUNITY: Township of Haines	
Category:	Education and Awareness
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Haines Township
Implementation Schedule:	Ongoing
Funding Source:	Act 205 VFRA funds
ACTION NO: 42	**Replace water holding tanks that do not meet current PA DEP standards.**
COMMUNITY: Township of Penn	
Category:	Structure and Infrastructure; Natural Systems Protection
Hazard(s) Addressed:	Environmental Hazards - Hazardous Materials Release
Lead Agency/Department:	Penn Township
Implementation Schedule:	Four years
Funding Source:	CFA, CDBG
ACTION NO: 43	**Develop response plans for potential civil disturbances.**
COMMUNITY: Borough of State College	
Category:	Plans and Regulations
Hazard(s) Addressed:	Civil Disturbance
Lead Agency/Department:	State College Chief of Police
Implementation Schedule:	Ongoing
Funding Source:	Borough, County, FEMA HMA and other grants
ACTION NO: 44	**Clean up after flooding.**
COMMUNITY: Borough of Milesburg	
Category:	Structure and Infrastructure; Natural Systems Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Milesburg Borough
Implementation Schedule:	6 months to 1 year
Funding Source:	PEMA, HMGP

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 45	Provide cyber-security and awareness training to all County staff to reduce risk and occurrence of phishing and malware attacks.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Cyber Terrorism
Lead Agency/Department:	Centre County Information Technology Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 46	Maintain and update threat protection program software.
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Cyber Terrorism
Lead Agency/Department:	Centre County Information Technology Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 47	Work with Pennsylvania Department of Health to increase awareness about treating and preventing opioid addiction.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Opioid Addiction
Lead Agency/Department:	Centre County Department of Criminal Justice Planning
Implementation Schedule:	Ongoing
Funding Source:	County, DOH
ACTION NO: 48	Equip municipalities, small business, and other organizations as applicable with Personal Protective Equipment (PPE) to proactively mitigate future spread of COVID-19.
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Pandemic and Infectious Disease
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Two years
Funding Source:	County, Community Recovery Block Grants
ACTION NO: 49	Coordinate with the Pennsylvania Department of Health to establish COVID-19 testing and vaccination sites, once a vaccine has been developed.
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Pandemic and Infectious Disease
Lead Agency/Department:	Centre County Office of Emergency Services; Centre County Commissioners
Implementation Schedule:	Two years
Funding Source:	County, DOH

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 50	Work with the Pennsylvania Department of Health to make the public aware of the availability of a Covid-19 vaccine, once a vaccine has been developed.
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Pandemic and Infectious Disease
Lead Agency/Department:	Centre County Office of Emergency Services; Centre County Department of Human Services
Implementation Schedule:	Two years
Funding Source:	County, Act 315
ACTION NO: 51	Maintain a GIS layer of the location of all permitted dams within the County, categorized by priority concern. Utilize dam location layer, inundation data, building footprints, and tax parcel information to develop potential evacuation measures in the event of a breach or failure.
COMMUNITY: Centre County	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Dam Failure
Lead Agency/Department:	Centre County GIS Office; Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 52	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: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Dam Failure; HHPD
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Annually by December (grant applications due June each year)
Funding Source:	County
ACTION NO: 53	Research model land use planning and zoning controls that minimize population growth near hazardous materials sites.
COMMUNITY: Centre County	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Environmental Hazards - Hazardous Materials Release
Lead Agency/Department:	Centre County Planning and Community Development Office
Implementation Schedule:	Ongoing
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 54	**Improve coordination with local municipalities to reduce risk from hazardous material incidents and conduct trainings to prepare for hazardous materials incidents.**
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Environmental Hazards - Hazardous Materials Release
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County, PEMA
ACTION NO: 55	**Ensure that emergency responders are training in response to incidents involving gasoline and other flammable liquid products.**
COMMUNITY: Centre County	
Category:	Education and Awareness
Hazard(s) Addressed:	Environmental Hazards - Hazardous Materials Release, Conventional Oil and Gas Wells, Unconventional Oil and Gas Wells
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	Ongoing
Funding Source:	County, PEMA
ACTION NO: 56	**Integrate hazard mitigation goals and objectives into updated regional and local comprehensive plans, where applicable.**
COMMUNITY: Centre County	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	All
Lead Agency/Department:	Centre County Planning and Community Development Office in coordination with planning regions and municipalities
Implementation Schedule:	Ongoing
Funding Source:	County
ACTION NO: 57	**Provide temporary high-speed internet hot spots during an emergency to first responder agencies if broadband availability is impacted.**
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Centre County Office of Emergency Services
Implementation Schedule:	5 Years
Funding Source:	County

Table 6.4-1: 2021 Centre County Mitigation Action Plan

ACTION NO: 58	Use existing road-stream crossing data to identify bridges and culverts that are most vulnerable to ice jams.
COMMUNITY: Centre County	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Centre County Planning and Community Development Office; Centre County GIS Office
Implementation Schedule:	5 Years
Funding Source:	County
ACTION NO: 59	Work with vendors of services to secure high-speed internet connection and enhance reliability throughout much of the valley where connectivity is poor.
COMMUNITY: Miles Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Miles Township
Implementation Schedule:	Ongoing
Funding Source:	Township
ACTION NO: 60	Replace existing fire equipment for the Miles Township Fire Company with new equipment that meets applicable standards.
COMMUNITY: Miles Township	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Miles Township
Implementation Schedule:	Ongoing
Funding Source:	Township

Evaluating mitigation actions involves judging each action against certain criteria to determine its feasibility and potential impact. Actions were 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 highest weighted criterion as part of the total prioritization score. Action 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. Of the 60 total actions, nine are ranked High Priority, 29 are ranked Medium Priority, with the remaining 22 ranked as Low Priority.

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
1	Conduct fire prevention inspections, especially in historic properties, annually.	2	2	1	1	1	1.5
2	Identify and execute the most cost effective floodproofing that will protect Phoenix Avenue business, residential, and critical facility (Bellefonte Emergency Medical Services) properties.	3	2	1	3	3	2.3
3	Increase current diking level surrounding the wastewater treatment plant.	3	2	1	3	3	2.3
4	Complete construction of flood wall to protect properties along Spring Creek between High Street and Lamb Street.	3	2	1	3	2	2.2
5	Continue study of stormwater runoff impacts in flood-prone area of E Street.	2	3	2	3	1	2.3
6	Obtain grant funding for fire suppression systems and equipment for large, economic anchor, buildings.	2	2	1	1	1	1.5
7	Identify and execute the most cost effective floodproofing projects, including buying properties in the floodplain and other structural or infrastructural improvements, that will effectively protect floodplain properties in the Borough of Milesburg.	3	2	1	3	2	2.2
8	Move vulnerable section of Borough's main waterline near State Route 445 and Elk Creek.	3	2	3	3	2	2.6
9	Continue to restrict future development at sites within the floodplain in Ferguson Township.	3	3	1	3	3	2.6

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
10	Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Spring Mills.	3	2	1	3	2	2.2
11	Provide public education and resources for identifying and reporting sinkholes and subsidence areas.	2	3	1	2	2	2.1
12	Identify and execute the most cost-effective floodwater mitigation project to protect property and access into flood-prone community of the Village of Coburn.	3	2	1	3	2	2.2
13	Complete development and implementation of source water protection plan to prevent unfiltered chemicals from entering Tussey sinkhole and ground water supply along US Route 322.	2	3	3	3	1	2.5
14	Continue to provide homeowners and developers advice on Karst topography when developing in known sinkhole prone areas.	2	3	1	2	1	2.0
15	Participate in the development and continued update of Emergency Action Plans.	2	2	2	2	2	2.0
16	Provide fire safety education program.	2	2	1	1	1	1.5
17	Acquire additional generators for shelter locations.	3	1	3	2	3	2.3
18	Continue to coordinate with PA State Game Commission and DCNR to conduct prescribed burns as necessary to reduce wildfire risk.	3	3	1	2	3	2.5
19	Continue to identify point of dispensing sites.	2	2	1	2	1	1.7

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
20	Provide information to private land owners about benefits of and obtaining crop insurance for drought protection.	3	3	1	3	1	2.3
21	Expand participation in the Firewise Program.	2	2	1	2	1	1.7
22	Continue participation in Centre County Task Force to coordinate issues on deep gas drilling, economics, and water quality.	2	3	1	3	1	2.1
23	Increase awareness of and participation in FEMA's Community Rating System (CRS) Program.	3	3	1	3	1	2.3
24	Coordinate the performance of detailed flood studies for the County's high-hazard areas to determine a full range of flood-recurrence intervals for use in future vulnerability analyses.	3	2	1	3	2	2.2
25	Obtain from PEMA Bureau of Recovery and Mitigation listings of repetitive loss properties within Centre County and distribute to municipal elected officials and managers.	1	2	1	3	1	1.6
26	Secure state or grant funding to update and adopt Act 167 Stormwater Management Plan.	2	2	1	3	2	2.0
27	Coordinate construction projects and winter storm response plans.	2	2	2	3	1	2.0
28	Maintain StormReady County status.	2	3	3	2	1	2.4
29	Continue participation in and encourage continued participation by municipality first responders in South Central Mountains Regional Task Force.	1	2	1	2	2	1.6

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
30	Coordinate with state and federal agencies on potential mitigation actions for terrorist activities.	1	2	1	2	2	1.6
31	Assist with coordination between County residents and utility companies on critical outage events.	3	2	1	1	3	2.0
32	Enhance the participation on the County Hazard Mitigation Steering Committee	3	2	3	3	3	2.7
33	Integrate hazard mitigation goals and objectives into County Phase II comprehensive planning efforts by developing a Hazard Mitigation Implementation Strategy chapter.	3	3	3	3	2	2.9
34	Identify water suppliers that are at greater risk to effects from drought and determine if they are candidates for interconnections from area suppliers.	2	1	1	3	1	1.5
35	Provide alternate power sources for each new or remodeled building on University Park Campus which provides essential functions.	2	2	1	1	2	1.7
36	Continue development and updates of Game Action Plans, to detail response to address post-game disturbances at Penn State.	2	2	1	1	1	1.5
37	Obtain and compile updated Department of Environmental Protection inundation data and Emergency Action Plan vulnerability data as it becomes available to inform Plan Update.	1	1	1	2	2	1.3

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
38	Obtain grant funding for the acquisition, demolition, demolition/reconstruction, relocation, and/or elevation of structures that are vulnerable to flooding.	3	2	1	3	1	2.0
39	Review floodplain ordinances annually to ensure compliance with current floodplain management and insurance standards and guidance.	2	3	1	3	2	2.3
40	Develop a Centre Region Taskforce to complete a detailed After Action Report and Improvement Plan (IP) for COVID-19. The taskforce will meet regularly to ensure implementation of the IP and plan for other infectious disease issues in the Centre Region.	1	3	1	3	1	1.9
41	Expand wildfire training to first responders, increase outreach to local officials to explain risks, and use the fire department to include wildfire awareness in their school educational program.	2	3	1	1	2	2.0
42	Replace water holding tanks that do not meet current PA DEP standards.	3	1	1	2	1	1.6
43	Develop response plans for potential civil disturbances.	2	2	1	1	2	1.7
44	Clean up after flooding.	1	2	1	3	1	1.6
45	Provide cyber-security and awareness training to all County staff to reduce risk and occurrence of phishing and malware attacks.	1	2	1	1	3	1.6
46	Maintain and update threat protection program software.	2	3	1	1	3	2.1
47	Work with Pennsylvania Department of Health to increase awareness about treating and preventing opioid addiction.	1	2	1	2	2	1.6

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
48	Equip municipalities, small business, and other organizations as applicable with Personal Protective Equipment (PPE) to proactively mitigate future spread of COVID-19.	3	3	1	3	2	2.5
49	Coordinate with the Pennsylvania Department of Health to establish COVID-19 testing and vaccination sites, once a vaccine has been developed.	3	3	1	3	2	2.5
50	Work with the Pennsylvania Department of Health to make the public aware of the availability of a Covid-19 vaccine, once a vaccine has been developed.	2	3	1	3	1	2.1
51	Maintain a GIS layer of the location of all permitted dams within the County, categorized by priority concern. Utilize dam location layer, inundation data, building footprints, and tax parcel information to develop potential evacuation measures in the event of a breach or failure.	2	2	2	1	3	2.0
52	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
53	Encourage land use planning and zoning controls to minimize population growth near hazardous materials sites.	2	2	1	2	1	1.7
54	Improve coordination with local municipalities to reduce risk from hazardous material incidents and conduct trainings to prepare for hazardous materials incidents.	1	2	1	2	2	1.6

Table 6.4-2: Mitigation Action Prioritization

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical Infrastructure	Total Score
55	Ensure that emergency responders are training in response to incidents involving gasoline and other flammable liquid products.	1	2	1	2	2	1.6
56	Integrate hazard mitigation goals and objectives into updated regional and local comprehensive plans, where applicable.	2	3	3	3	2	2.7
57	Provide temporary high-speed internet hot spots during an emergency in the event that broadband availability is impacted.	1	2	1	2	3	1.8
58	Use existing road-stream crossing to identify bridges and culverts that are most vulnerable to ice jams.	1	2	1	3	3	1.9
59	Work with vendors of services to secure high-speed internet connection and enhance reliability throughout much of the valley where connectivity is poor.	2	2	1	2	3	2.0
60	Replace existing fire equipment for the Miles Township Fire Company with new equipment that meets applicable standards.	2	1	1	1	3	1.5

7.PLAN MAINTENANCE

7.1 UPDATE PROCESS SUMMARY

Once this plan has received approval from PEMA and FEMA, the plan will be adopted by the Centre County Board of Commissioners 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 this HMP. This section establishes a method to monitor how the plan will be evaluated and maintained in the future.

Monitoring, evaluating, and updating this plan is critical to maintaining its value and success in Centre County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. The HMSC elected to keep the methodology and schedule similar to what is outlined in the 2015 HMP, but to put more emphasis on integrating the mitigation goals, objectives, and actions identified in the Mitigation Strategy into the other ongoing planning efforts to ensure implementation and tracking of actions throughout the five-year plan maintenance process.

7.2 MONITORING, EVALUATING, AND UPDATING THE PLAN

The HMSC established for the 2021 HMP is designated to lead plan maintenance processes of monitoring, evaluation, and updating with support and representation from all participating municipalities. The HMSC will coordinate maintenance efforts, but the input needed for effective periodic evaluations will come from community representatives, local emergency management coordinators and planners, the general public, and other stakeholders, including Penn State University and state agencies. The HMSC will oversee the progress made on the implementation of action items identified in the 2021 HMP and modify actions, as needed, to reflect changing conditions. The HMSC will meet annually to discuss specific coordination efforts that may be needed with other stakeholders. The Centre County OES Deputy Director, Jody Lair, will lead the HMSC during the annual reviews.

CCPCDO will lead the effort to integrate mitigation goals, objectives, and actions into the county and regional comprehensive planning efforts. Specifically, CCPCDO will ensure risk assessments and applicable mitigation actions are included in the development of comprehensive planning documents. CCPCDO will report to the HMSC the progress of these actions and will identify if there are changes that need to be made to the risk assessment or the

mitigation strategy based on information developed during the comprehensive planning process.

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 HMSC to provide updates on applicable mitigation actions and feedback on changing hazard vulnerabilities within their community.

In addition, the municipal monitor will be responsible for reviewing the planning and land use regulatory element of the municipality's capability assessment to identify potential opportunities for continued incorporation of the HMP into local planning mechanisms and will also identify locally generated plans, information, reports, etc. that may be capable of being incorporated into the update of the 2021 HMP.

The HMSC will oversee the progress made on the implementation of action items at least annually, but also as deemed necessary based on the occurrence of a disaster or another occasion that necessitates the review of the HMP. Evaluation of the 2021 HMP will not only include an investigation of whether mitigation actions were completed, but also an assessment of how effective those actions were in mitigating losses. A review of the qualitative and quantitative benefits (or avoided losses) of mitigation activities will support this assessment. Results of the evaluation will then be compared to the goals and objectives established in the plan and decisions will be made regarding whether actions should be discontinued or modified in any way in light of new developments in the community. Progress will be documented by the HMSC for use in the next HMP Update.

Upon each HMP evaluation, the HMSC 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. All state and federal mitigation funding provided to the County or local municipalities will be reported in subsequent plan updates.

The 2021 HMP will be updated by the FEMA approved five-year anniversary date, as required by the Disaster Mitigation Act of 2000, or following a disaster event. Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the five-year review process, the following questions will be considered as criteria for assessing the effectiveness of the Centre County 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?

Issues that arise during monitoring and evaluation which require changes to the risk assessment, mitigation strategy, and other components of the plan will be incorporated during future updates.

7.3 CONTINUED PUBLIC INVOLVEMENT

As was done during development of this 2021 HMP, the HMSC plans to 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 Centre County government website. Some rural areas in the County do not have internet access and require communication through physical means. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and the county website. The public is encouraged to submit comments on the HMP at any time. The HMSC will incorporate all relevant comments during the next update of the hazard mitigation plan.

Comprehensive Plans, Capital Improvements Programs, Building Codes, Municipal Floodplain Management Regulations, Emergency Operations Plans, and Zoning Ordinances are identified for incorporation of hazard mitigation actions once the 2021 HMP 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 Centre County OES and CCPCDO, 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 Officer and forwarded to FEMA for final review and approval-pending-adoption on March 1, 2021. FEMA granted approval-pending-adoption on _____, 2021. Full approval from FEMA was received after each jurisdiction adopted the plan.

This section of the plan includes copies of the local adoption resolutions passed by Centre County and its municipal governments. Adoption resolution templates are provided to assist the County and municipal governments with recommended language for future adoption of the HMP. The completed Local Mitigation Plan Review Crosswalk is included as an appendix to this plan.

Centre County 2021 Hazard Mitigation Plan Update

County Adoption Resolution

Resolution No. _____

Centre County, Pennsylvania

WHEREAS, the municipalities of Centre 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, Centre 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 Centre County 2021 Hazard Mitigation Plan Update has been developed by the Centre County Office of Emergency Services and the Centre County Planning and Community Development Office in cooperation with other county departments, local municipal officials, institutional stakeholders, and the citizens of Centre County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Centre County 2021 Hazard Mitigation Plan Update, and

WHEREAS, the Centre County 2021 Hazard Mitigation Plan Update 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 Centre that:

- The Centre County 2021 Hazard Mitigation Plan Update 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 Centre County 2021 Hazard Mitigation Plan Update are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: CENTRE COUNTY COMMISSIONERS

_____ By _____

By _____

By _____

Centre County 2021 Hazard Mitigation Plan Update

Municipal Adoption Resolution

Resolution No. _____

<Borough/Township of Municipality Name>, Centre County, Pennsylvania

WHEREAS, the *<Borough/Township of Municipality Name>*, Centre 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 Centre County 2021 Hazard Mitigation Plan Update has been developed by the Centre County Office of Emergency Services and the Centre County Planning and Community Development Office in cooperation with other county departments, local municipal officials, institutional stakeholders, and the citizens of Centre County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Centre County 2021 Hazard Mitigation Plan Update, and

WHEREAS, the Centre County 2021 Hazard Mitigation Plan Update 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 *<Borough/Township of Municipality Name>*:

- The Centre County 2021 Hazard Mitigation Plan Update is hereby adopted as the official Hazard Mitigation Plan of the *<Borough/Township>*, and
- The respective officials and agencies identified in the implementation strategy of the Centre County 2021 Hazard Mitigation Plan Update are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: *<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>*

_____ By _____

By _____

9. APPENDICES

Appendix A	Bibliography
Appendix B	Local Mitigation Plan Review Crosswalk
Appendix C	Meeting and Other Participation Documentation
Appendix D	Local Municipality Flood Vulnerability Maps
Appendix E	Critical Facilities
Appendix F	Hazus Methodology and Results Report
Appendix G	Dam Failure Hazard Profile (Section 4.3.16)