COUNTY OF WASHINGTON

2021

HAZARD MITIGATION PLAN UPDATE

PREPARED FOR:

Washington County
Department of Public Safety
100 W Beau Street, C-1
Washington, Pennsylvania 15301

County of Washington

PREPARED BY:

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Certification of Annual Review Meetings

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

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2017			
2018	October 30, 2018	NFIP training	Ryan Frazee
2019			
2020			
2021	April 4, 2021	Catfish and Chartiers Creek Flood Study Final Results Presentation	Ryan Frazee
2022			
2023			
2024			
2025			
2026			
2027			

**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)

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

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**Sensitive Information – Not for public distribution*

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List of Acronyms

ACRONYM	FULL NAME	ACRONYM	FULL NAME
BRIC	Building Resilient Infrastructure and Communities	NFPA	National Fire Protection Association
CFR	Code of Federal Regulations	NHC	National Hurricane Center
CKCOG	Central Keystone Council of Governments	NIDIS	National Integrated Drought Information System
CRS	Community Ratings System	NOAA	National Oceanic and Atmospheric Association
DCED	Department of Community and Economic Development	NWS	National Weather Service
DCNR	Department of Conservation and Natural Resources	PEIRS	Pennsylvania Emergency Incident Reporting System
DCNR-BOF	Department of Conservation and Natural Resources-Bureau of Forestry	PA DEP	Pennsylvania Department of Environmental Protection
DMA	Disaster Mitigation Act	PaGWIS	Pennsylvania Groundwater Information System
EOP	Emergency Operations Plan	PASDA	Pennsylvania Spatial Data Access
EOC	Emergency Operations Center	PDM	Pre-Disaster Mitigation Assistance Program
EMC	Emergency Management Coordinator	PDSI	Palmer Drought Severity Index
EPA	Environmental Protection Agency	PEMA	Pennsylvania Emergency Management Agency
FEMA	Federal Emergency Management Agency	PennDOT	Pennsylvania Department of Transportation
FIRM	Flood Insurance Rate Map	RF	Risk Factor
FIS	Flood Insurance Survey	SALDO	Subdivision and Land Development Ordinance
FMA	Flood Mitigation Assistance Program		
HMGP	Hazard Mitigation Grant Program	SFHA	Special Flood Hazard Area

ACRONYM	FULL NAME	ACRONYM	FULL NAME
HMPT	Hazard Mitigation Planning Team	SOG	Standard Operating Guide
HMPU	Hazard Mitigation Plan Update	UCC	Universal Construction Code
HVA	Hazards Vulnerability Analysis	US DOT	United States Department of Transportation
ICC	International Code Council	USACE	United States Army Corps of Engineers
IBC	International Building Code	USDA	United States Department of Agriculture
NCDC	National Climatic Data Center	USGS	United States Geological Survey
NDIS	National Drought Information System	WCCD	Washington County Conservation District
NDMC	National Drought Mitigation Center	WYO	Write Your Own
NFIP	National Flood Insurance Program		

1. Introduction

1.1. Background

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

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

A Hazard Mitigation Plan (HMP) is a community-driven, living document that communities use to reduce their vulnerability to hazards by analyzing data collected at the county, state, and national levels, documenting administrative, technical, and planning resources, and by developing a mitigation strategy to implement projects to better prepare and reduce those

County of Washington

Washington County Department of Public Safety has taken an all-hazards approach to this Hazard Mitigation Plan Update.

vulnerabilities. The County and the municipalities must have a plan to maintain access to certain mitigation grants. The HMP is organized into the following sections: Community Profile, Planning Process, Risk Assessment, Capability Assessment, Mitigation Strategy, and Plan Maintenance. The HMP is developed by the Hazard Mitigation Steering Committee (HMSC), which is comprised of officials from Washington County and Hazard Mitigation Planning consultants from Michael Baker International, and the Hazard Mitigation Planning Team, which is comprised of representatives from each of the municipalities in Washington County as well as other stakeholder from around the County.

2010 Hazard Mitigation Plan

The initial Hazard Mitigation Plan for Washington County was completed in 2010 and followed an outline developed by PEMA in 2009, which provides a standard format for all hazard mitigation plans in the commonwealth of Pennsylvania,. A total of 22 of Washington County's 66 municipalities participated in the planning process via questionnaires, meetings, and identification of mitigation projects. The 2010 Plan identified the County as being susceptible to a range of natural hazards including flood, tornado and windstorm, winter storm, subsidence, landside, earthquake, and drought.

2015 Plan Update

The 2015 Plan Update built on the foundation laid by the 2010 Plan. The Update utilized new data and analysis to highlight the hazards that threaten the County. The 2015 Plan Update reviewed and reprioritized hazards based on changes in frequency and severity with updated data and stakeholder input. The Plan Update detailed new mitigation actions selected during the planning process and provided status updates on the progress of mitigation actions as well as any revisions, deletions, or modifications made to address high priority hazards. Of the 66 municipalities, 45 participated in the update.

2021 Plan Update

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

The 2021 Plan Update consists of a thorough review and evaluation of the 2015 Plan. Each chapter in the 2021 HMP has been updated as necessary per information and updates received from the HMPT; geospatial data collected from the County, State, and National levels; and guidance from the Pennsylvania Emergency Management Agency (PEMA) and FEMA. The Plan Update reviews data hazards carried over from the 2015 update as well as profiling five new hazards added for 2021, Pandemic and Infectious Disease, Opioid Addiction and Response, Transportation Incident, Utility Interruption, and Civil Disturbance. This update also reprioritizes hazards based on changes in frequency and severity. The Plan Update includes a review of previously selected mitigation actions, which were revised and modified based on feedback provided by municipalities and planning partners, as well as new

actions identified to address current mitigation priorities. The Plan Maintenance section describes how the Plan will be updated and maintained during the next five-year cycle.

The 2021 Hazard Mitigation Plan Update comprises seven sections that follow the 2020 PEMA Standard Operating Guide (SOG) Model Plan Outline: 1 Introduction, 2 Community Profile, 3 Planning Process, 4 Risk Assessment, 5 Capability Assessment, 6 Mitigation Strategy and 7 Plan Maintenance.

1.2. Purpose

This plan was developed for the purpose of:

- Providing a blueprint for reducing property damage and saving lives from the effects of future natural and human-made hazards in Washington County;
- Complying with state and federal legislative requirements for County mitigation in order for the County to be eligible for federal and technical assistance from State and Federal hazard mitigation programs;
- Identifying, introducing, and implementing cost-effective hazard mitigation measures in order to accomplish County goals and objectives and to raise awareness and acceptance of hazard mitigation; and
- Improving community resiliency following a disaster event.

Adoption of this plan ensures that Washington County and participating jurisdictions continue to be eligible to apply for and receive certain federal grant funds that are administered by the Commonwealth of Pennsylvania for FEMA. This plan complies with the requirements of the Disaster Mitigation Act of 2000 and its implementing regulations published in Title 44 of the Code of Federal Regulations (CFR) Section 201.6 which requires that local governments (communities/counties), as a condition of receiving federal disaster mitigation funds, have a mitigation plan that describes the process for identifying hazards, creating a risk assessment and vulnerability analysis, identifying and prioritizing mitigation strategies, and developing an implementation schedule for the County and each of the municipalities.

Congress authorized the establishment of a Federal grant program to provide financial assistance to States and communities for flood mitigation planning and activities. FEMA has designated this Flood Mitigation Assistance (FMA).

1.3. Scope

In December of 2020, Washington County contracted with Michael Baker International Inc. to support HMP Update development in compliance with the requirements of the Disaster Mitigation Act of 2000. The HMP Update was funded by Hazard Mitigation Assistance (HMA) funds from FEMA and administered by the Pennsylvania Emergency Management Agency (PEMA). The Plan Update is a multi- jurisdictional plan that covers Washington County and its 66 municipalities.

The Washington 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. The original plan is being updated in order to continually address both natural and human-made hazards determined to be of significant risk to the County and/or its local municipalities. Updates will take place following significant disasters and/or after a review each year and/or when other plan updates impact the HMP.

1.4. Authority and References

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended;
- CFR, Title 44, Parts 201 and 206;
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended; and
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 *et seq*.

Authority for this plan originates from the following Commonwealth of Pennsylvania sources:

- Pennsylvania Emergency Management Services Code. Title 35, Pa C.S. Section 101;
- Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988; and
- Pennsylvania Stormwater Management Act of October 4, 1978. P.L. 864, No. 167.

The following FEMA guides and reference documents were used to prepare this document:

- FEMA 386-1: *Getting Started*. September 2002.
- FEMA 386-2: *Understanding Your Risks: Identifying Hazards and Estimating Losses*. August 2001.
- FEMA 386-3: *Developing the Mitigation Plan*. April 2003.
- FEMA 386-4: *Bringing the Plan to Life*. August 2003.
- FEMA 386-5: *Using Benefit-Cost Review in Mitigation Planning*. May 2007.
- FEMA 386-6: *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*. May 2005.
- FEMA 386-7: *Integrating Manmade Hazards into Mitigation Planning*. September 2003.
- FEMA 386-8: *Multijurisdictional Mitigation Planning*. August 2006.
- FEMA 386-9: *Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects*. August 2008.
- FEMA: *Local Mitigation Planning Handbook.* March 2013.
- FEMA: *Local Mitigation Plan Review Guide.* October 2011.
- FEMA: *National Fire Incident Reporting System 5.0: Complete Reference Guide*. January 2008.
- FEMA: *Hazard Mitigation Assistance Unified Guidance*. February 2015.

- FEMA: *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. March 2013
- FEMA: *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.* January 2013.
- FEMA: National Flood Insurance Program Fact Sheet. May 2016.
- FEMA P-758: Substantial Improvement / Substantial Damage Desk Reference. May 2010.

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. August 2020.
- PEMA: Pennsylvania State Hazard Mitigation Plan, 2019 Update.

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

Washington County is located in the southwest corner of Pennsylvania, north of Greene County, and consists of 66 municipalities (32 townships, 32 boroughs, and 2 cities). The County is bordered by Beaver County to the north, Allegheny County to the northeast, a small portion of Westmoreland County to the east, Fayette County to the southeast, and Greene County to the south. The County is bordered by several West Virginia counties including Hancock County to the northwest, Brooke and Ohio Counties to the west, and Marshall County to the southwest (see Figure 2.1-1: Washington County Base Map). Washington County is 857 square miles, or about 548,000 acres, including Hillman State Park, County parks, Cross Creek, Mingo Creek, and Ten Mile Creek, as well as several State Game Lands. Two major trails, the Panhandle and Montour Trail, run through the County. The Panhandle Trail is a 29-mile bicycle and walking trail occupying an abandoned railroad corridor and links to the larger Montour Trail. It begins at Walkers Mill station in Walker's Mill, Pennsylvania and ends around Weirton, West Virginia. The Montour Trail, similarly was a former railroad, and is part of 204-mile rails to trails project between Pittsburgh, Pennsylvania and Cumberland, Maryland that makes up part of a 400-mile trail system between Pittsburgh and Washington, D.C. This system is known as the Great Allegheny Passage.

Washington County is covered by three Hydraulic Unit Code (HUC) 8 watersheds, the Upper Ohio, Upper Ohio-Wheeling, and Lower Monongahela. The Monongahela River, which is fed by the Lower Monongahela Watershed within the County, also forms the eastern boundary of the County. There are 12 HUC10 watersheds that cover Washington County, including: Buffalo Creek, Chartiers Creek, Cross Creek, Kings Creek-Ohio River, Lower Monongahela River, Racoon Creek, Redstone Creek, Robinson Fork-Enlow Fork, South Fork Ten Mile Creek, Ten Mile Creek, Upper Monongahela River, and Wheeling Creek. Figure 2.1-2 shows the locations of HUC8 watersheds throughout the county and Figure 2.1-3 shows the location of HUC10 watersheds. Many of these watersheds are supported by local watershed alliances as well as the larger Washington County Watershed Alliance. These groups are influential in restoring floodplains and encouraging municipalities to develop and adopt storm water management ordinances consistent with the guidelines established by the Department of Environment Protection and the Washington County Flood Taskforce.

Washington County experiences an average annual temperature of about 50 degrees Fahrenheit and an average annual precipitation of approximately 40 inches. During the winter months (December through February), the average temperature is around 30° F, and the average precipitation is about 8.6 inches in which fluctuations during dry and wet years are not noticeably extreme. Spring months (March through May) bring moderate average temperatures of around 50° F and precipitation levels of 11 inches. Average summer (June through August) temperatures are 70° F and average precipitation values are about 12.25 inches. As the year enters the fall season (September through November), moderate

temperatures and precipitation levels are prevalent. The average temperature is 53° F and the average precipitation is 9.5 inches.

Figure 2.1-1 Base Map of Washington County

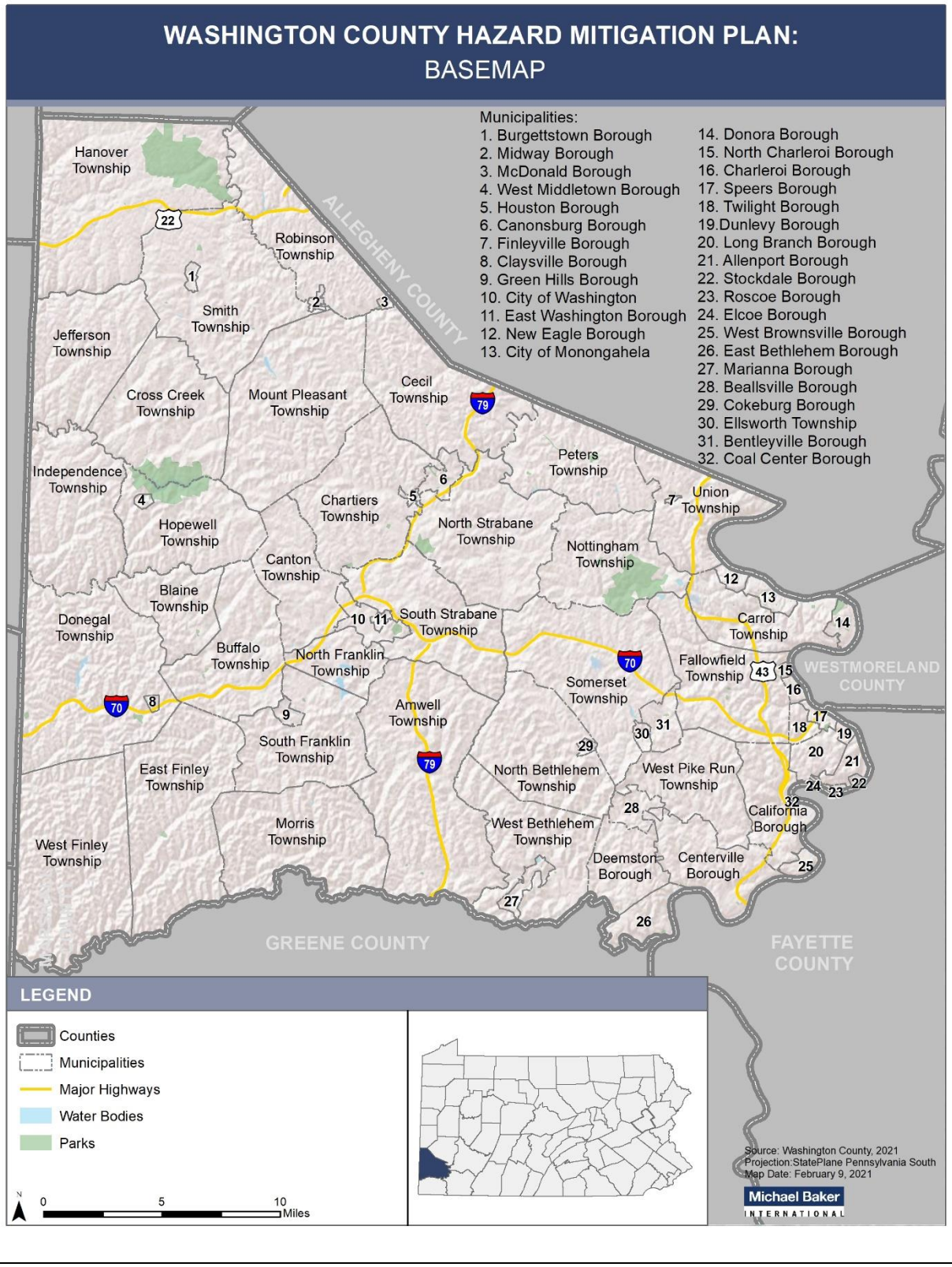


Figure 2.1-2 Washington County HUC8 Watersheds

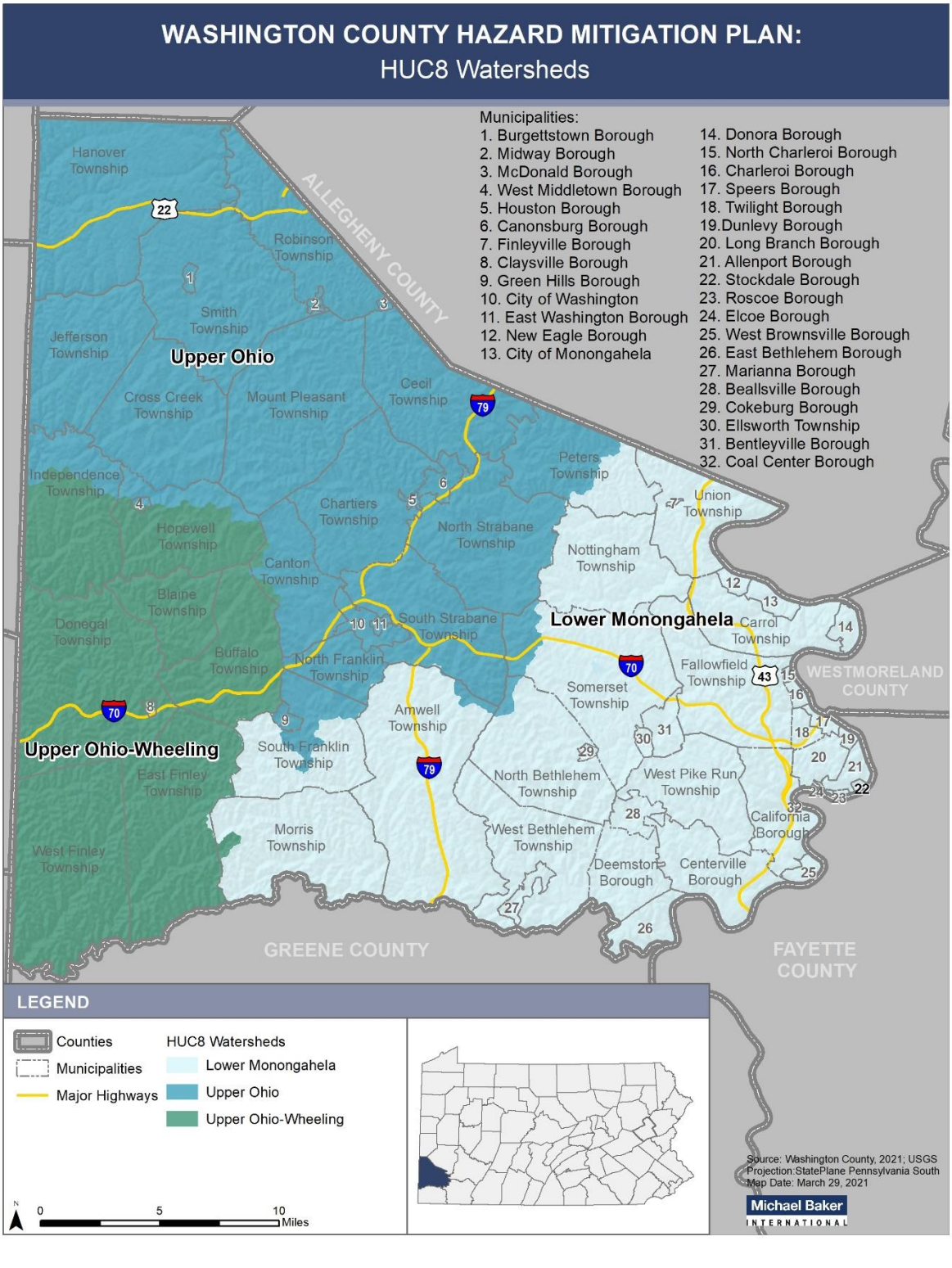
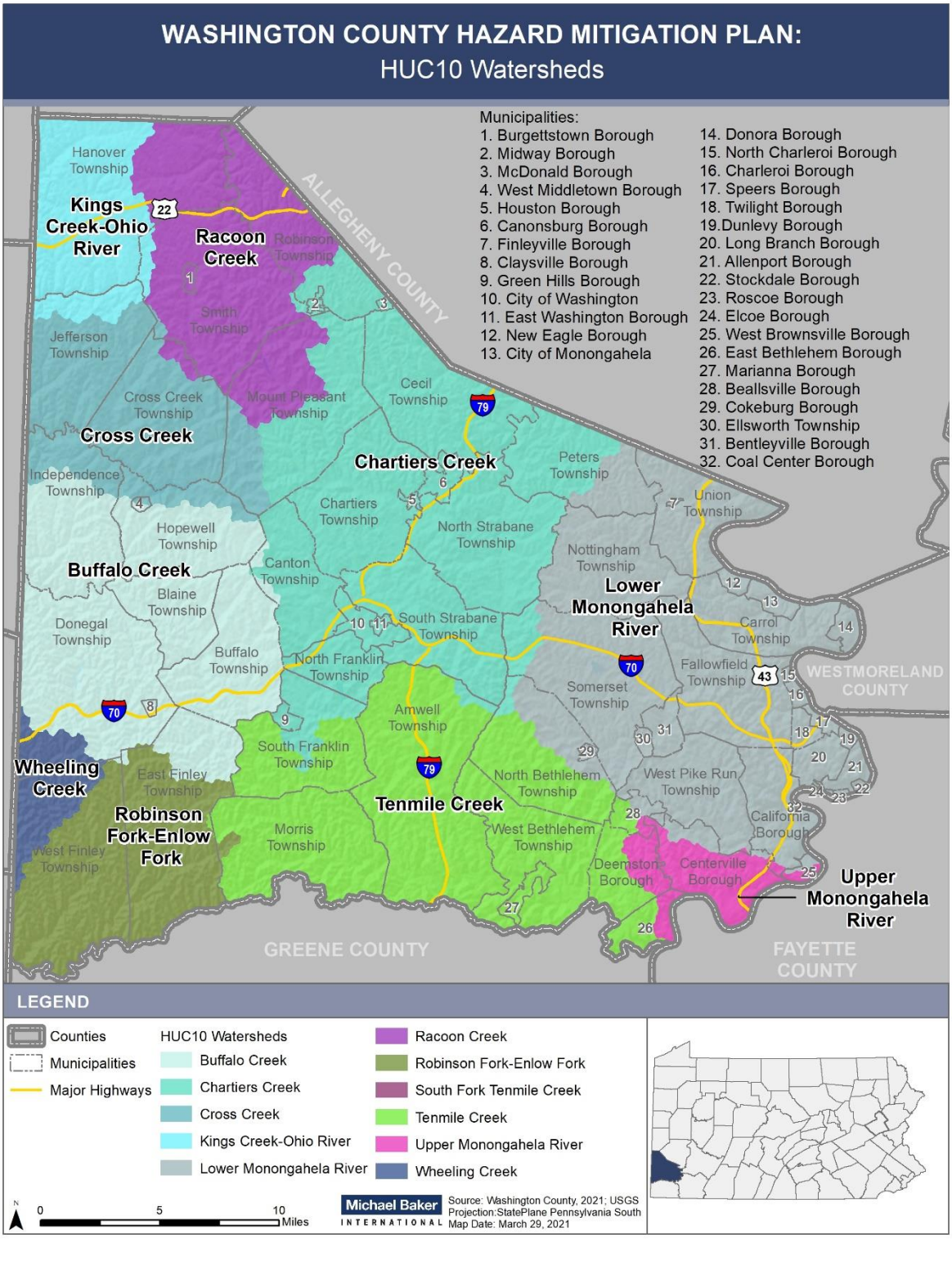


Figure 2.1-3 Washington County HUC10 Watersheds



2.2. Community Facts

Washington County was formed on March 28, 1781. It was the first county in the United States to be named after President George Washington. From 1791 to 1794, during the presidency of the County's namesake, many residents of Washington County took part in what has since become known as "The Whiskey Rebellion", a tax protest in response to an excise tax placed on whiskey. A festival of the same name is held annually outside of the County Courthouse in the City of Washington. Washington County is home to Meadowcroft Village; known nationwide for its 16,000 year old archeological dig and re-created 19th century village. Perhaps the most visited landmark in Washington County is its 23 covered bridges.

US Route 79 travels north-south through Washington County entering Amwell Township and traveling north toward Cecil Township. Interstate 70 also crosses the County connecting to the west to West Virginia and Ohio. US 79 and 70 intersect in the middle of the County around the City of Washington. U.S. Route 40, also known as the 'Main Street of America', one of America's first highways, travels east-west through the County. The locations of major highways and municipalities are provided in Figure 2.2-1.

There are fifteen public school districts throughout the County: Avella, Bentworth, Bethlehem-Center, Brownsville, Burgettstown, California, Canon-McMillan, Charleroi, Chartiers-Houston, Fort Cherry, McGuffey, Peters Township, Ringgold, Trinity, and Washington School Districts. The County is also home to several higher learning institutions, California University of Pennsylvania, Washington & Jefferson College, and extension campuses of Community College of Allegheny County, and Waynesburg University.

2.3. Population and Demographics

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

According to the U.S. Census, the population of Washington County in 2019 was estimated at 207,212. The following table provides a distribution of County population by municipality obtained from the U.S. Census Bureau's American Community Survey (ACS). As shown in the table below, the population increase by 0.2% between 2010 and 2019. Eight municipalities had decreases greater than 20%. Green Hills Borough had the most significant population increase at 57.1%, though the total population of Green Hills Borough of 44 people is incredibly small.. Blaine Township, Claysville Borough and Dunlevy Borough also had significant population increases. Municipalities along the Allegheny County boarder, like Cecil and Peters Townships have seen population increases in the last decade.

Table 2.3-1 Population in Washington County by Municipality (U.S. Census Bureau ACS, 2019)			
MUNICIPALITY	2010 POPULATION	2019 POPULATION	PERCENT CHANGE (%)
Allenport Borough	436	552	26.6%
Amwell Township	3,780	3,674	-2.8%
Beallsville Borough	437	510	16.7%
Bentleyville Borough	2,610	2,441	-6.5%
Blaine Township	492	735	49.4%
Buffalo Township	2,204	2,236	1.5%
Burgettstown Borough	1,517	1,350	-11.0%
California Borough	6,592	6,347	-3.7%
Canonsburg Borough	8,917	8,844	-0.8%
Canton Township	8,474	8,134	-4.0%
Carroll Township	5,664	5,496	-3.0%
Cecil Township	10,995	12,479	13.5%
Centerville Borough	3,277	3,163	-3.5%
Charleroi Borough	4,247	3,953	-6.9%
Chartiers Township	7,713	7,964	3.3%
Claysville Borough	624	885	41.8%
Coal Center Borough	131	134	2.3%
Cokeburg Borough	706	537	-23.9%
Cross Creek Township	1,433	1,646	14.9%
Deemston Borough	946	777	-17.9%
Donegal Township	2,737	2,287	-16.4%
Donora Borough	4,937	4,598	-6.9%
Dunlevy Borough	303	412	36.0%
East Bethlehem Township	1,951	2,030	4.0%
East Finley Township	1,440	1,545	7.3%
East Washington Borough	2,336	1,986	-15.0%
Elco Borough	281	286	1.8%
Ellsworth Borough	1,009	797	-21.0%
Fallowfield Township	4,337	4,193	-3.3%
Finleyville Borough	398	282	-29.1%
Green Hills Borough	28	44	57.1%
Hanover Township	2,679	2,619	-2.2%

Table 2.3-1 Population in Washington County by Municipality (U.S. Census Bureau ACS, 2019)			
MUNICIPALITY	2010 POPULATION	2019 POPULATION	PERCENT CHANGE (%)
Hopewell Township	1,061	960	-9.5%
Houston Borough	1,368	1,352	-1.2%
Independence Township	1,479	1,579	6.8%
Jefferson Township	1,324	1,165	-12.0%
Long Branch Borough	612	461	-24.7%
Marianna Borough	468	1,633	248.9%
McDonald Borough	1984	450	-77.3%
Midway Borough	882	867	-1.7%
Monongahela City	4,373	4,138	-5.4%
Morris Township	1,261	988	-21.6%
Mount Pleasant Township	3,499	3,503	0.1%
New Eagle Borough	2,317	2,349	1.4%
North Bethlehem Township	1,513	1,518	0.3%
North Charleroi Borough	1,212	1,351	11.5%
North Franklin Township	4,619	4,549	-1.5%
North Strabane Township	12,796	14,437	12.8%
Nottingham Township	2,945	3,024	2.7%
Peters Township	20,528	21,983	7.1%
Robinson Township	2,078	1,819	-12.5%
Roscoe Borough	659	722	9.6%
Smith Township	4,483	4,389	-2.1%
Somerset Township	2,676	2,656	-0.7%
South Franklin Township	3,385	3,217	-5.0%
South Strabane Township	9,111	9,440	3.6%
Speers Borough	1,210	1,067	-11.8%
Stockdale Borough	560	388	-30.7%
Twilight Borough	254	229	-9.8%
Union Township	5,682	5,715	0.6%
Washington City	13,915	13,532	-2.8%
West Bethlehem Township	1,331	1,366	2.6%
West Brownsville Borough	880	917	4.2%
West Finley Township	782	815	4.2%

Table 2.3-1 Population in Washington County by Municipality (U.S. Census Bureau ACS, 2019)			
MUNICIPALITY	2010 POPULATION	2019 POPULATION	PERCENT CHANGE (%)
West Middletown Borough	139	94	-32.4%
West Pike Run Township	1,851	1,603	-13.4%
TOTAL	**206,868**	**207,212**	0.2%

The population of Washington County is concentrated around the Monongahela River and the surrounding municipalities. There are also greater concentrations around the cities of Washington and Monongahela as well as closer to the Allegheny County border on the northeastern side of Washington County. Washington County has historically experienced varying increases and decreases in population since 1920.

Table 2.3-2 2019 Income levels in Washington County (U.S. Census Bureau, 2019)			
INCOME	WASHINGTON COUNTY	PENNSYLVANIA	NATIONAL
Median Household Income	$63,543	$63,463	$65,712
Median Family Income	$85,110	$81,075	$80,944
Per Capita Income	$35,735	$36,748	$39,871

Approximately 74.4% of housing units in the County are single-unit structures, 20.7% are multi-unit structures, and 4.9% are manufactured homes which are more vulnerable to tornados, windstorms, and flooding. Nearly 60% of homes in the County were constructed prior to 1970 and 51% of those homes were constructed prior to 1940. The top five reported ancestries are: Italian, German, Irish, Polish, and English. Additional demographic facts are provided in Table 2.3-3.

Table 2.3-3 Demographic Summary of Washington County (US Census ACS, 2019)		
DEMOGRAPHIC CATEGORY	WASHINGTON COUNTY	PENNSYLVANIA
Population, 2019 Estimate	207,212	12,291,530
Median Age, 2019 Estimate	44.5	40.8
Percent Persons Under 18 Years Old, 2019 Estimate	19.40%	20.6%
Percent Persons 65 Years Old and Over, 2019 Estimate	21.00%	17.80%
Percent Female Persons, 2019 Estimate	50.80%	51.02%
Percent Male Persons, 2019 Estimate	49.20%	48.98%
RACIAL DEMOGRAPHICS	WASHINGTON COUNTY	PENNSYLVANIA
Percent White Persons, 2019 Estimate	93.30%	80.50%
Percent Black Persons, 2019 Estimate	3.30%	11.20%

Table 2.3-3 Demographic Summary of Washington County (US Census ACS, 2019)		
Percent American Indian and Alaska Native Persons, 2019 Estimate	0.20%	0.20%
Percent Asian, 2019 Estimate	1.20%	3.40%
Percent Native Hawaiian and Other Pacific Islander, 2019 Estimate	0%	0%
Percent Persons Reporting Two or More Races, 2019 Estimate	1.90%	2.50%
Percent Persons of Hispanic or Latino Origin, 2019 Estimate	1.80%	7.30%
Percent White Persons Not Hispanic, 2019 Estimate	91.90%	76.40%
POVERTY RATE	WASHINGTON COUNTY	PENNSYLVANIA
Percent Population in poverty, 2019 Estimate	10%	12%

Projected population growth in Washington County between 2010 and 2040 shows that the greatest population change is expected to be seen in the Northern portion of the county in municipalities near the border with Allegheny County including, Cecil Township (32.5%), Peters Township (48.4%), North (59.4%) and South Strabane (29.6%) Townships. Projections show that these municipalities could see population increases from less than 1% to nearly 60%. The lowest population increases are expected to be seen in the more rural western and southern areas of the County like Hanover Township and Donegal Township.

2.4. Land Use and Development

According to the Washington County Economic Development Strategy, the County's contemporary development pattern generally follows the I-79/U.S. 19 corridor south from the Allegheny County line down the center of the County to the City of Washington area. Historically, population and economic activities were centered in the Mon Valley and the City of Washington. The shift in the development pattern is a reflection of Interstates 70 and 79 and in-migration from Allegheny County, and the decline of the steel and primary metals industry. Growth along I-70 is more spaced out with pockets of development along the corridor surrounded by rural areas. Accordingly, those municipalities displaying more prosperous socioeconomic conditions are generally located in the middle of the County. Groupings of municipalities located in the extreme northwest corner of the county and the northern portion of the Mon Valley also display prosperous socioeconomic conditions. Groupings of less prosperous municipalities are concentrated in the southwest, southeast, and northwest corners of the County and the Washington-Canton area. Figure 2.4-1 shows the current land use in Washington County.

Much of the population is concentrated in the central and north-central parts of the county, running north from North Franklin Township to Cecil and Peters Townships. Not surprisingly, the heavy population areas coincide with the locations of public sewer and water infrastructure, as well as new commercial development and housing developments.

Based on the 2005 Comprehensive Plan, future growth is expected to remain concentrated in the center of the county, primarily north of the Greater City of Washington Area. Revitalization of the City of Washington at that time was drawing new investment and attracting business and residents. The historically active Mon Valley region was expected to experience some growth, but most Mon Valley communities were anticipated to remain relatively unchanged. Figure 2.4-2 shows Washington County target areas for investment as of 2005. Each of the target investment areas includes at least one special flood hazard area, but the I-79/US-19 Corridor Investment Area contains a large segment of the SHFA around Chartiers Creek. Additionally, all of the target areas are in places with steep and north-facing slopes, and the target areas on the eastern part of Washington County are in areas more susceptible to subsidence. Additionally, new development is likely to occur along the PA Route 576 corridor. This new highway will serve as a southern beltway around the Pittsburgh Area connecting the Pittsburgh Airport to the steel valley of the Monongahela River.

At the time of this plan update the County is in the process of updating its comprehensive plan. The preliminary analysis conducted for the comprehensive plan has indicated that the areas identified in the 2005 plan are still relevant, and economic development will likely continue to focus around these areas. One new trend that has been recognized is that some of the transition areas identified in the 2005 plan have since filled in with development. Future growth will be comprehensively reassessed once the updated Comprehensive Plan is completed.

Figure 2.4-1 Current Land Uses in Washington County

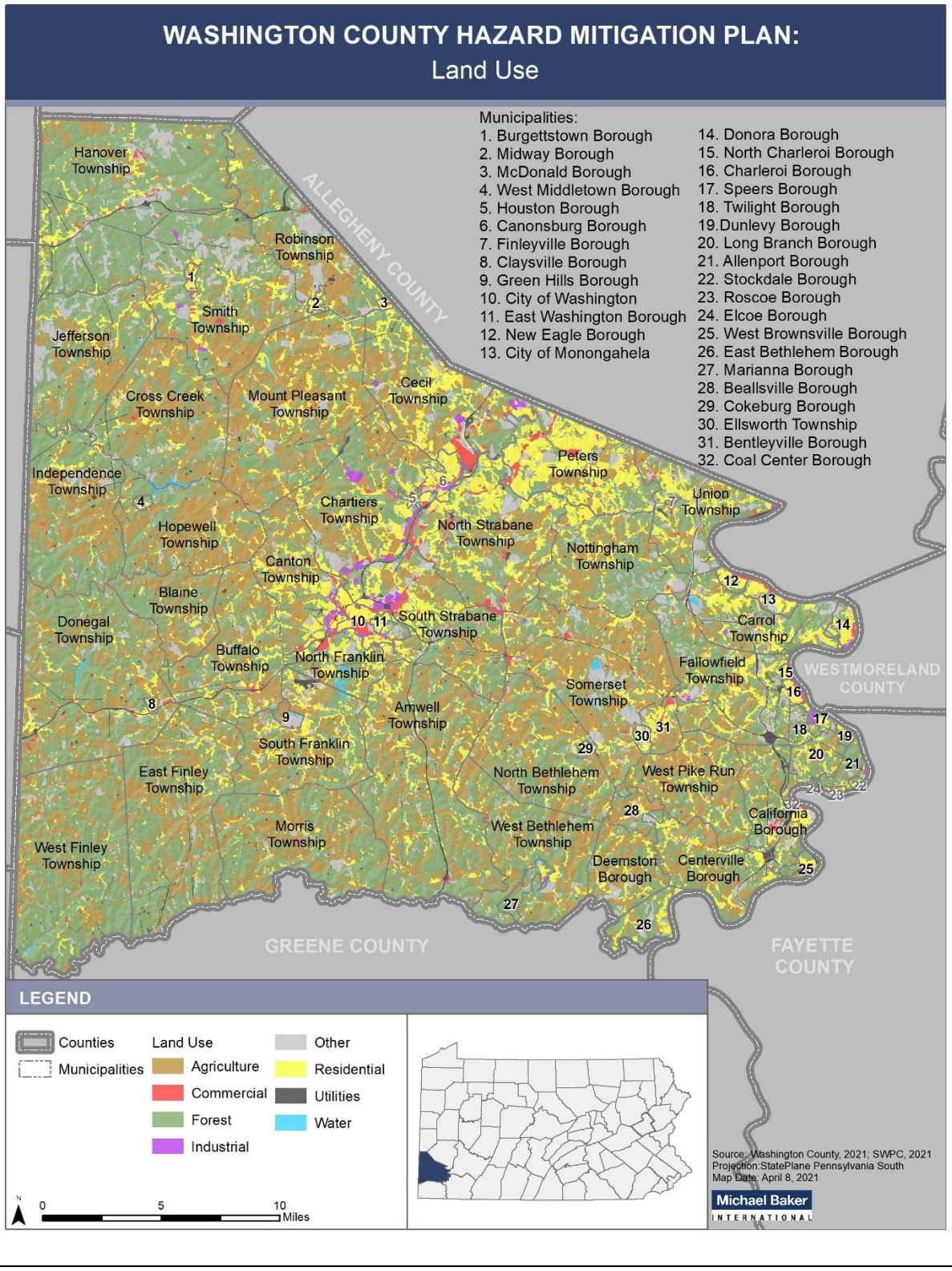
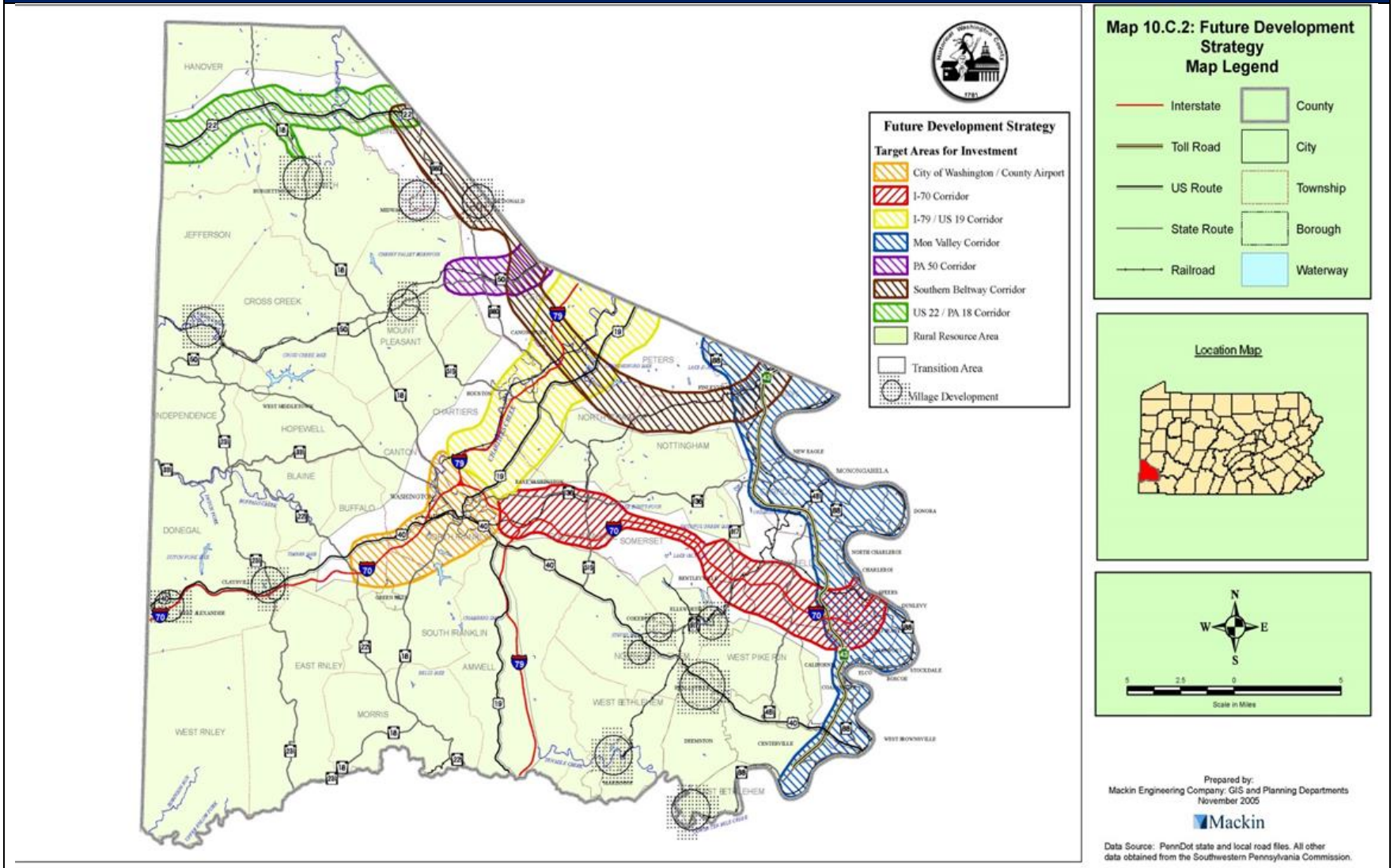


Figure 2.4-2 Washington County Targeted Growth Areas (Washington County Future Development Strategy, 2006)



2.5. Data Sources and Limitations

Gathering and analyzing new data about natural hazards and the community was critical to the process of updating the plan. Many spatial data sources used in the plan were accessed via Washington County's Open Data Website:

- Address Points
- Amenities
- Building Footprints
- Municipalities
- Parks
- Streets
  Trails

The County GIS Department provided parcel data with tax assessment values.

Washington County's Effective Flood Insurance Rate Map (FIRM) (issued on 9/30/2015) was downloaded from FEMA's Flood Map Service Center. This data provides flood frequency and elevation information used in the flood hazard risk assessment. Additional base map data was from PA DCNR.. Also, population data from the 2010 Census and 2019 estimated populations were obtained from the U.S. Census Bureau (2019). 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 and on each map 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, hazard data from the National Centers for Environmental Information (NCEI) database was utilized. NCEI is a division of the US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by NCEI from data gathered by the National Weather Service (NWS), another division of NOAA. NCEI then presents it on its website in various formats. The data used for this plan came from the U.S. 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, 2019). The database currently contains hazard event data from January 1950 to June 2021. Other federal datasets came from USGS, the National Hurricane Center, and NOAA's Storm Prediction Center. High Hazard Potential Dam (HHPD) data was collected from PA DEP and USACE's 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.

Hazus is a powerful risk assessment methodology for analyzing potential losses from floods, hurricane winds, and earthquakes. In Hazus, current scientific and engineering knowledge is coupled with the latest GIS technology to produce estimates of hazard-related damage before or after a disaster occurs. Version 4.2 of this software was used to estimate losses for floods in Washington County. For more information about the methodology employed to prepare the Hazus model and estimate losses, see Appendix F.

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. The list of critical facilities was developed based on information from the Washington County Open Data Website and insight provided by the Steering Committee. Critical facilities have been identified in Washington County to include 21 types of facilities essential to the health and welfare of the community. Table 2.5-1 summarizes the critical facilities in Washington County by type and data source. For a complete listing of critical facilities, please see Appendix E.

Several critical facility GIS datasets were obtained from the Department of Homeland Security's (DHS) Homeland Infrastructure Foundation-Level Data (HIFLD) Open data portal, and FEMA's Comprehensive Data Management System (CDMS). The HIFLD Open data portal aggregates data from hundreds of regional and local data providers to compile national datasets of essential assets and infrastructure. As of 2019, this data portal provided access to over 330 national geospatial data layers within the open public domain (DHS HIFLD, 2019). FEMA's CDMS was used to gather geospatial data for the few types of critical facilities not available through the HIFLD Open Data portal. A component of FEMA's Hazus software, the CDMS allows users to export the default geospatial data that Hazus uses to estimate potential losses. This default geospatial data includes national data for essential facilities, high potential loss facilities, selected transportation and lifeline systems, agriculture, vehicles, and demographics. More information on the sources for the Hazus default data can be found at https://www.fema.gov/summary-databases-hazus-multi-hazard.

Table 2.5-1 Critical Facilities by Municipality and Type																						
MUNICIAPLITY	CELL TOWER	CEMETERY	COMPRESSOR STATION	COUNTY FACILITY	DAM	DAY CARE	ELECTRIC POWER FACILITIES	EMS	EOC/911 CENTER	FIRE DEPARTMENT	GOV. COMMUNICATION TOWERS	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	PARKS AND REC FACILITY	POLICE STATION	PUBLIC SCHOOL	PUBLIC WORKS FACILITY	SARA FACILITY	SEWER FACILITY	WATER FACILITY	GRAND TOTAL
Allenport Borough	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	4	8
Amwell Township	7	0	7	0	2	0	0	0	0	2	0	0	1	0	4	0	1	1	3	0	33	61
Beallsville Borough	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	1	3	9
Bentleyville Borough	2	0	0	0	0	1	0	0	0	1	0	0	1	0	3	0	3	0	2	0	0	13
Blaine Township	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	5	10
Buffalo Township	2	0	2	0	1	0	0	0	0	0	0	0	1	0	3	0	2	1	3	0	1	16
Burgettstown Borough	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	4
California Borough	2	1	0	0	0	1	0	0	0	1	0	0	1	0	1	2	6	1	4	2	5	27
Canonsburg Borough	1	1	0	1	0	1	0	0	0	1	0	0	1	1	4	1	6	1	2	0	2	23
Canton Township	3	1	1	0	1	1	0	0	0	2	0	0	1	1	0	0	1	0	10	0	22	44
Carroll Township	5	2	0	0	4	2	0	0	0	2	0	1	1	2	3	1	4	0	3	2	14	46
Cecil Township	7	1	0	0	5	2	0	0	0	3	0	0	1	0	4	1	6	0	11	5	20	66
Centerville Borough	2	1	0	0	0	0	0	0	0	2	0	0	1	0	3	1	0	0	0	1	8	19
Charleroi Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	5	1	0	1	6	1	5	21

Table 2.5-1 Critical Facilities by Municipality and Type

MUNICIAPLITY	CELL TOWER	CEMETERY	COMPRESSOR STATION	COUNTY FACILITY	DAM	DAY CARE	ELECTRIC POWER FACILITIES	EMS	EOC/911 CENTER	FIRE DEPARTMENT	GOV. COMMUNICATION TOWERS	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	PARKS AND REC FACILITY	POLICE STATION	PUBLIC SCHOOL	PUBLIC WORKS FACILITY	SARA FACILITY	SEWER FACILITY	WATER FACILITY	GRAND TOTAL
Chartiers Township	0	2	4	2	0	2	0	0	0	1	0	0	1	1	1	1	4	0	19	0	28	66
Claysville Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	4
Coal Center Borough	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Cokeburg Borough	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	4
Cross Creek Township	0	1	1	0	3	1	0	0	0	0	0	0	1	0	2	0	2	0	0	0	16	27
Deemston Borough	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	6	0	1	0	3	14
Donegal Township	4	2	2	0	3	1	0	0	0	1	1	0	1	0	1	1	0	1	2	0	15	36
Donora Borough	0	2	0	1	0	1	0	0	0	1	0	0	1	0	7	1	0	1	7	1	1	24
Dunlevy Borough	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	4	8
East Bethlehem Township	2	0	0	0	1	0	0	0	0	1	0	0	1	0	4	1	0	0	1	2	29	42
East Finley Township	3	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	9	17
East Washington Borough	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Elco Borough	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	3

Table 2.5-1 Critical Facilities by Municipality and Type

MUNICIAPLITY	CELL TOWER	CEMETERY	COMPRESSOR STATION	COUNTY FACILITY	DAM	DAY CARE	ELECTRIC POWER FACILITIES	EMS	EOC/911 CENTER	FIRE DEPARTMENT	GOV. COMMUNICATION TOWERS	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	PARKS AND REC FACILITY	POLICE STATION	PUBLIC SCHOOL	PUBLIC WORKS FACILITY	SARA FACILITY	SEWER FACILITY	WATER FACILITY	GRAND TOTAL
Ellsworth Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	0	0	0	0	0	3	7
Fallowfield Township	4	1	3	0	4	0	0	0	0	1	0	0	1	0	3	1	5	1	9	2	30	65
Finleyville Borough	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	4
Green Hills Borough	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Hanover Township	3	1	0	0	10	0	0	0	0	1	0	0	1	0	2	1	0	1	3	1	6	30
Hopewell Township	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	4	8
Houston Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	3
Independence Township	1	0	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0	1	2	1	7	17
Jefferson Township	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	11	17
Long Branch Borough	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	4
Marianna Borough	0	0	1	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	7	12
McDonald Borough	0	0	0	0	0	1	0	0	0	1	0	0	1	0	2	1	0	0	1	0	0	7
Midway Borough	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1

Table 2.5-1 Critical Facilities by Municipality and Type

MUNICIAPLITY	CELL TOWER	CEMETERY	COMPRESSOR STATION	COUNTY FACILITY	DAM	DAY CARE	ELECTRIC POWER FACILITIES	EMS	EOC/911 CENTER	FIRE DEPARTMENT	GOV. COMMUNICATION TOWERS	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	PARKS AND REC FACILITY	POLICE STATION	PUBLIC SCHOOL	PUBLIC WORKS FACILITY	SARA FACILITY	SEWER FACILITY	WATER FACILITY	GRAND TOTAL
Monongahela, City of	0	1	0	0	0	2	0	0	0	1	0	0	1	0	5	1	0	1	2	1	8	23
Morris Township	1	0	1	0	2	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	6	13
Mount Pleasant Township	5	1	2	0	2	1	0	0	0	2	0	0	1	0	3	1	3	0	3	1	26	51
New Eagle Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	2	0	15	21
North Bethlehem Township	3	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	2	11	22
North Charleroi Borough	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	4
North Franklin Township	3	1	0	0	2	0	0	0	0	3	0	1	1	1	2	1	3	1	0	1	17	42
North Strabane Township	5	1	0	1	3	5	0	1	0	3	0	1	1	3	2	1	4	0	13	1	31	76
Nottingham Township	2	0	0	1	2	1	0	0	0	0	0	0	1	0	3	0	0	0	0	0	6	16
Peters Township	4	4	0	0	9	11	0	0	0	2	0	0	1	3	11	1	7	1	5	4	15	78
Robinson Township	0	0	2	0	3	0	1	0	0	0	0	0	2	0	1	1	0	0	1	1	20	34
Roscoe Borough	0	0	0	0	0	1	0	0	0	1	0	0	1	0	2	0	0	0	0	0	0	5
Smith Township	2	1	5	0	0	2	0	0	0	2	0	0	1	0	3	1	4	0	6	1	22	51
Somerset Township	4	0	0	0	7	1	0	0	0	0	0	0	1	0	2	0	2	1	3	2	53	78

Table 2.5-1 Critical Facilities by Municipality and Type

MUNICIAPLITY	CELL TOWER	CEMETERY	COMPRESSOR STATION	COUNTY FACILITY	DAM	DAY CARE	ELECTRIC POWER FACILITIES	EMS	EOC/911 CENTER	FIRE DEPARTMENT	GOV. COMMUNICATION TOWERS	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	PARKS AND REC FACILITY	POLICE STATION	PUBLIC SCHOOL	PUBLIC WORKS FACILITY	SARA FACILITY	SEWER FACILITY	WATER FACILITY	GRAND TOTAL
South Franklin Township	1	0	0	0	0	0	0	0	0	1	0	0	1	0	2	0	2	1	2	3	5	19
South Strabane Township	5	2	0	0	2	1	0	0	0	2	0	0	1	1	4	1	1	1	12	2	15	50
Speers Borough	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	3	1	5	13
Stockdale Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	1	0	0	0	0	0	5
Twilight Borough	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2
Union Township	4	0	1	0	3	0	3	0	0	1	0	0	1	0	4	0	4	0	6	0	24	52
Washington, City of	2	0	0	6	2	7	0	0	1	3	1	1	1	0	5	3	5	1	6	0	3	47
West Bethlehem Township	0	2	1	0	0	1	0	0	0	1	0	0	1	0	2	0	0	1	0	0	23	32
West Brownsville Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	0	0	0	1	0	0	5
West Finley Township	4	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	2	1	14	24
West Middletown Borough	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	3
West Pike Run Township	0	0	2	0	1	2	0	0	0	0	0	0	1	0	0	1	0	0	2	2	5	16
GRAND TOTAL	93	33	40	12	84	54	4	1	1	61	2	4	65	13	128	31	87	21	166	43	623	1,575

3. Planning Process

3.1. Update Process and Participation Summary

This Washington County HMP was originally developed in 2010 and then updated and adopted for implementation in 2015. The 2010 Plan, 2015 Plan, and this updated 2021 Washington 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 February 2021. Michael Baker International assisted the County and its municipalities throughout the update process. The Washington County 2021 HMP Update was completed for FEMA review in September, 2021.

Out of 66 municipalities 49 participated (74%) in the hazard mitigation planning process through attending at least one meeting and submitting at least one form/ sharing applicable information.

With social distancing restrictions in place throughout the planning process ensuring full municipal participation was difficult. Washington County is a primarily rural community and many residents have limited internet connectivity making virtual participation challenging. To combat this, steps were taken throughout the planning process to make participation as easy as possible for municipalities. Written and electronic invitations were extended to all municipalities one month prior to each meeting. Follow up email notifications were sent one week prior to each meeting. All meetings and workshops were recorded and posted to the project website, https://www.pennsylvaniahmp.com/washington-county-hmp, to accommodate stakeholder schedules. All forms and surveys were available on the project website and municipalities were directed to the project website in written and electronic communications as well as during meetings and workshops. Municipalities were emailed or called as needed to request completed forms and documents as well as to provide technical assistance in completing the appropriate forms. The individuals listed in Table 3.2-2 served on the 2021 countywide HMPT during the planning process.

Table 3.1-1 Hazard Mitigation Planning Process Participation

MUNICIPALITY/ORG	PARTICIPANT(S)
Allenport Borough	
Amwell Township	
Beallsville Borough	Richard Westen, Miranda Bennett
Bentleyville Borough	Stan Glowaski
Blaine Township	Lois Miller, Randy Sochor
Buffalo Township	Michelle Markley, Secretary-Treasurer
Burgettstown Borough	Thomas Repole, EMC
California Borough	Jamison Roth, Thomas McCarthy
Canonsburg Borough	Mark Mazzeo
Canton Township	Chris Hammett; Sam Carroll, Harshman CE Group; Stephanie Pettit
Carroll Township	Ken Hillman

Table 3.1-1 Hazard Mitigation Planning Process Participation	
MUNICIPALITY/ORG	PARTICIPANT(S)
Cecil Township	Shawn Bukovinsky, Fire Chief; Lt. Richard Egizio; Det. James Brose; Elizabeth Ross, Zoning Director; Jacque King; Bill Bottorff, Director-DPW; Renato Ruzzini, EMS Coordinator; Donald Gennuso, Manager
Centerville Borough	Cheryl Matesich, Secretary/Treasurer
Charleroi Borough	Joe Manning, Borough Manager
Chartiers Township	Fred Simpson, Jody Noble
Claysville Borough	Brad Simms, EMC
Coal Center Borough	
Cokeburg Borough	
Cross Creek Township	
Deemston Borough	
Donegal Township	Zachary Prescott, EMC
Donora Borough	Terri Petroske, Borough Administrator
Dunlevy Borough	
East Bethlehem Township	Jay Edwards, EMC; Maryann Giovanelli, Secretary
East Finley Township	Rick Dorsey; EMC Melissa Metz, Secretary; Richard Kaufmann, Engineer
East Washington Borough	Maryann Weinstein, Gerald Coleman
Elco Borough	Allan Waraksa
Ellsworth Borough	Mark Segedi, Borough Council President
Fallowfield Township	Bruce Smith, Chairman; Rick Pudliner, EMA Coordinator; Wayne Ray, Deputy EMA Coordinator
Finleyville Borough	Richard Kaufmann HMT Associates, Engineer
Green Hills Borough	Terry George, Mayor
Hanover Township	James Donohue, EMC; Dale Handick
Hopewell Township	Richard Kaufmann HMT Associates, Engineer
Houston Borough	James Stubenbordt, Mayor, Richard Kaufmann, Engineer
Independence Township	Chris Maust, EMC
Jefferson Township	Christopher Lawrence, Supervisor; Mike Maltony, EMC
Long Branch Borough	Joe DeBlassio
Marianna Borough	David Dillon, Renee Minskey
McDonald Borough	
Midway Borough	Doug Baird, Fire Chief
City of Monongahela	Aaron Benny
Morris Township	Jim Watt
Mt Pleasant Township	Gary Farner, Darla Protch
New Eagle Borough	Paul Pro, EMA
North Bethlehem Township	
North Charleroi Borough	
North Franklin Township	Erin Dinch
North Strabane Township	Mark Grimm, Neil Kelly, Dan Federico
Nottingham Township	Rich Yosi
Peters Township	Mike McLaughlin
Robinson Township	Doug Baird, EMA
Roscoe Borough	Tom Wilkinson
Smith Township	Robert Cassidy, Co-Chairman
Somerset Township	
South Franklin Township	Tyler Link, Manager

Table 3.1-1 Hazard Mitigation Planning Process Participation	
MUNICIPALITY/ORG	PARTICIPANT(S)
South Strabane Township	Scott Reese
Speers Borough	Curtis Rice, Jody Burkholder
Stockdale Borough	
Twilight Borough	Paul Minardi, President
Union Township	Sam Carroll, Harshman CE Group
City of Washington	Sarah Boyce, Municipal Engineer, Joe Manning
West Bethlehem Township	Lars Lange
West Brownsville Borough	Richard Black, EMC; Jim Pflugh, Council President
West Finley Township	Jean Morris
West Middletown Borough	
West Pike Run Township	Dale Tiberie, EMC

Table 3.1-2 Plan Participation Documentation

STAKEHOLDER	MEETING ATTENDANCE				DOCUMENTATION PROVIDED					MET PARTICIPATION REQUIREMENTS
	KICK-OFF MEETING	RAMS MEETING	DRAFT PLAN REVIEW MEETING	OTHER MEETING OR CALL	HAZARD-RISK FORM	CAPABILITY ASSESSMENT FORM	NEW MITIGATION ACTION FORM	COMPLETED MITIGATION ACTION REVIEW FORM	NFIP SURVEY	
Municipal Participation										
Allenport Borough										
Amwell Township										
Beallsville Borough	O	O	O		O	O			O	O
Bentleyville Borough				O			O	O		O
Blaine Township		O				O		O	O	O
Buffalo Township				O		O			O	O
Burgettstown Borough	O	O			O	O				O
California Borough	O	O			O		O			O
Canonsburg Borough				O				O		O
Canton Township	O	O	O		O	O	O		O	O
Carroll Township			O				O	O	O	O
Cecil Township	O	O			O	O				O
Centerville Borough	O									
Charleroi Borough			O			O		O	O	O
Chartiers Township	O	O			O	O	O			O
Claysville Borough	O	O	O			O		O		O
Coal Center Borough										
Cokeburg Borough										
Cross Creek Township										
Deemston Borough										
Donegal Township				O	O	O		O		O
Donora Borough		O						O		O
Dunlevy Borough										
East Bethlehem Township	O							O		O

Table 3.1-2 Plan Participation Documentation

STAKEHOLDER	MEETING ATTENDANCE				DOCUMENTATION PROVIDED					MET PARTICIPATION REQUIREMENTS
	KICK-OFF MEETING	RAMS MEETING	DRAFT PLAN REVIEW MEETING	OTHER MEETING OR CALL	HAZARD-RISK FORM	CAPABILITY ASSESSMENT FORM	NEW MITIGATION ACTION FORM	COMPLETED MITIGATION ACTION REVIEW FORM	NFIP SURVEY	
East Finley Township	O							O		O
East Washington Borough	O					O		O		O
Elco Borough		O						O		O
Ellsworth Borough				O			O	O		O
Fallowfield Township	O	O				O		O		O
Finleyville Borough				O	O					O
Green Hills Borough				O			O	O		O
Hanover Township	O	O			O	O				O
Hopewell Township			O	O		O	O	O		O
Houston Borough	O			O						
Independence Township	O	O	O		O	O			O	O
Jefferson Township		O	O			O				O
Long Branch Borough		O						O		O
Marianna Borough	O	O	O		O	O				O
McDonald Borough										
Midway Borough	O	O	O		O	O			O	O
City of Monongahela	O				O	O	O		O	O
Morris Township	O	O			O			O		O
Mt Pleasant Township	O					O				O
New Eagle Borough	O							O		O
North Bethlehem Township				O						
North Charleroi Borough										

Table 3.1-2 Plan Participation Documentation

STAKEHOLDER	MEETING ATTENDANCE				DOCUMENTATION PROVIDED					MET PARTICIPATION REQUIREMENTS
	KICK-OFF MEETING	RAMS MEETING	DRAFT PLAN REVIEW MEETING	OTHER MEETING OR CALL	HAZARD-RISK FORM	CAPABILITY ASSESSMENT FORM	NEW MITIGATION ACTION FORM	COMPLETED MITIGATION ACTION REVIEW FORM	NFIP SURVEY	
North Franklin Township	O	O	O		O	O	O	O	O	O
North Strabane Township	O	O	O		O	O	O			O
Nottingham Township	O	O	O		O	O				O
Peters Township	O					O				O
Robinson Township	O	O	O		O	O				O
Roscoe Borough	O							O		O
Smith Township	O	O	O			O		O	O	O
Somerset Township				O						
South Franklin Township				O				O		O
South Strabane Township	O	O	O			O		O		O
Speers Borough	O			O						
Stockdale Borough										
Twilight Borough				O			O	O		O
Union Township	O							O		O
City of Washington	O		O			O		O		O
West Bethlehem Township	O									
West Brownsville Borough	O	O	O		O	O				O
West Finley Township		O	O			O		O		O
West Middletown Borough										
West Pike Run Township	O	O			O	O				O

Table 3.1-2 Plan Participation Documentation

STAKEHOLDER	MEETING ATTENDANCE				DOCUMENTATION PROVIDED					MET PARTICIPATION REQUIREMENTS
	KICK-OFF MEETING	RAMS MEETING	DRAFT PLAN REVIEW MEETING	OTHER MEETING OR CALL	HAZARD-RISK FORM	CAPABILITY ASSESSMENT FORM	NEW MITIGATION ACTION FORM	COMPLETED MITIGATION ACTION REVIEW FORM	NFIP SURVEY	
Additional Stakeholder Participation										
Washington County	O	O								
California University	O									
FEMA	O									
PEMA	O									
Washington County Conservation District	O	O								
American Red Cross	O									
AHN/Jefferson and Canonsburg Hospitals	O									
Washington Health System	O									
Greene County	O	O								
Southwestern Pennsylvania Commission	O									
NOAA	O									

3.2. The Planning Team

The 2021 HMP follows the Pennsylvania Hazard Mitigation Model Plan Outline developed by PEMA in 2013 which provides a standardized format for all multi-jurisdictional HMPs in the Commonwealth of Pennsylvania. The Plan Update was led by the Hazard Mitigation Steering Committee (HMSC) and informed by the Hazard Mitigation Planning Team (HMPT). Community leaders from each municipality in Washington County, stakeholders from other County agencies and organizations, local colleges, and surrounding counties were invited by the Washington County Department of Public Safety to act as members of the HMPT.

Members of the HMSC are listed below in Table 3.2-1. The HMSC met February 2, 2021 to discuss the plan update process including FEMA and PEMA requirements and guidance, a schedule for deliverables and meetings, participation and contacts for the HMPT, and currently available data and documentation to inform the 2021 update.

Table 3.2-1 Washington County Hazard Mitigation Plan Steering Committee

PARTICIPANT	TITLE
Ryan Frazee	Emergency Planning Officer, Washington County Department of Public Safety
Jason Theakston	Land Use Planner, Washington County Planning Commission
Madeleine Fincham	Lead Hazard Mitigation Planner, Michael Baker International
Kevin Brown	Hazard Mitigation Planner, Michael Baker International

The 2021 Washington County Hazard Mitigation Planning Team included:

- Municipal Officials
- Washington County Departments and Agencies
- Washington County Planning Commission
- Washington County Conservation District
- Washington Health System
- Allegheny Health Network/Jefferson and Canonsburg Hospitals
- California University of Pennsylvania
- Washington & Jefferson College

The HMPT included municipal officials, Washington County government representatives, non-profit organizations, and other stakeholders such as regional healthcare networks and local colleges and universities. Representatives from neighboring counties in Pennsylvania such as Allegheny, Beaver, Fayette, Greene, Westmoreland were invited to participate in the HMP process. West Virginia counties that border Washington County, Brooke; Hancock; Marshall; and Ohio, were also invited to participate. Greene County attended meetings and provided documentation. Other stakeholders that were part of the HMPT are listed at the end of Table 3.2-2. Stakeholder and other participation documentation are provided in Appendix C – Meeting and Other Participation Documentation.

Stakeholders participated by attending meetings and submitting valuable input and feedback to inform the planning process in the form of completed surveys, questionnaires, or verbal comment. Letters, email, and telephone, along with the project website, were utilized to

coordinate and communicate with the HMPT. A brief description of the events of each meeting including concerns and questions raised by HMPT members is provided in Section 3.3. In addition, detailed meeting minutes describing events of each meeting are available in Appendix C – Meeting and Other Participation Documentation.

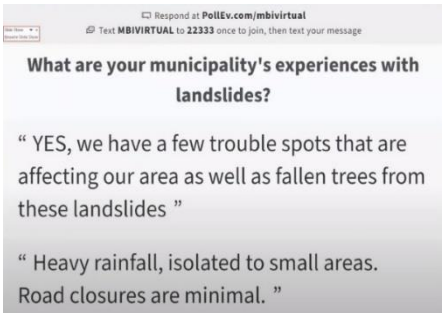
3.3. Meetings and Documentation

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

February 2, 2021 – The Steering Committee Kick-Off Meeting was attended by the Washington County Department of Public Safety and the consultant to go over the planning process and major milestones including the schedule for HMPT meetings and anticipated HMP submission dates. The group also discussed planning requirements, relevant stakeholders, and the availability of geospatial data and other plans and documentation for integration. HMSC members also discussed the addition of two new hazards, Pandemic and Opioid Addiction and Response, for the 2021 HMP Update.

March 16, 2021 – The Planning Team Kick-Off Meeting was held virtually due to social distancing requirements from the ongoing COVID-19 pandemic. Planning team members discussed the project scope, schedule, goals, the planning process, participation and engagement, and next steps. Hazards from the 2015 plan were reviewed with the HMPT at the kick-off. Morning and evening sessions were offered to maximize opportunities for participation. During, as well as after the Kick-Off meeting, and other meetings, County staff, municipal representatives, and interested stakeholders provided vital information on changes in hazard risk and local capabilities to mitigate those risks since the last HMP update. After the Kick-Off meeting stakeholders noted via email that there had been an increase in landsides since the last HMP Update. Municipal attendees completed an "Evaluation of Hazards and Risk Form" to identify their jurisdictional risk to each hazard. Capability Assessment Surveys were also completed by municipal attendees.

Figure 3.3-1 Online Polling During the April 27, 2021 Risk Assessment & Mitigation Solutions Workshop



April 27, 2021 – The Risk Assessment and Mitigation Solutions Workshop was held virtually and covered Washington County's hazard vulnerability and new hazards to be profiled in the 2021 HMP. Morning and evening sessions were offered to provide additional opportunity for participation. Participants discussed progress of mitigation actions from the 2015 Plan Update and identified additional mitigation actions that would help reduce or eliminate potential losses. Online polling software was used to gather input from stakeholders. Participants noted historic and ongoing issues related to multiple hazards. Feedback from this meeting also identified three additional hazards to profile in the plan update – Civil Disturbance, Transportation Incidents and Utility Interruption.

Mapping presented highlighted areas of concern such as undermining in areas of development and growth, and discussion of the PA Route 576 corridor and what the future may mean. Stakeholders and the HMPSC agreed the relationship between the HMP and the Comprehensive Plan, currently being updated, will be critical.

June 2021 – Several One-on-One Meetings were held with representatives from municipalities that either could not attend any prior meetings or attended but required assistance in completing the required forms. During these meetings members of the HMSC worked with individual municipalities to explain the HMP process, go over materials covered at the Kick-Off and Risk Assessment Workshop, as well as to provide technical assistant in completing forms.

July 22, 2021– The Draft Plan Review Meeting provided information about the update process, evaluation, and general findings in the Washington County HMP. Additionally, instructions about when and how to review the Draft HMP were covered as well as a final timeline for the review and submission of the HMP to PEMA and FEMA. Morning and evening webinars were offered and attended. Online polling software was used to gather input from stakeholders. Participants noted historic and ongoing issues related to multiple hazards.

In order to obtain information from municipalities and other stakeholders, forms and surveys were distributed and collected throughout the planning process. Forms were sent via email and were posted to the plan website (image below), https://www.pennsylvaniahmp.com/washington-county-hmp, for download. Forms and questionnaires were completed and returned in between scheduled meetings. Meeting agendas and presentations for HMPT meetings are provided in Appendix C – Meeting and Other Participation Documentation along with completed forms and surveys.

3.4. Public & Stakeholder Participation

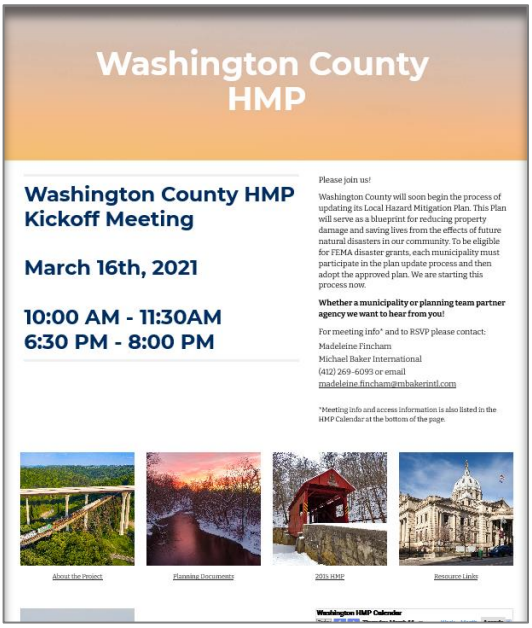
Each municipality was given multiple opportunities to participate in the plan update process through invitation to the above outlined meetings.. The tools listed below were distributed with meeting invitations as well as on the plan update website. These tools helped to solicit information, data, and comments from both local municipalities and other key stakeholders in Washington County. Worksheets and responses to these worksheets and surveys are included in Appendix C: Meeting and Other Participation Documentation.

- Capability Assessment Survey: Collects information on local planning, regulatory, administrative, technical, fiscal, political, and resiliency capabilities that can be included in the plan's Capability Assessment section.
- Evaluation of Hazards and Risk Form: Collects information from the HMPT regarding whether there have been changes to the frequency of occurrence, magnitude of impact, or geographic extent of hazards identified in the 2015 plan. In addition, the form asks members of the HMPT to select any additional hazards they believe should be considered for inclusion in the 2021 plan.

- Mitigation Progress Report: This form was specific to each jurisdiction and included all actions for that jurisdiction in the 2015 HMP with space to provide the current status of each action and document any progress made.

- New Mitigation Action Form: This form was provided to communities that wanted to include a new action in the HMP. The purpose was to collect details about the action, including priority, responsible parties, potential partners, potential funding sources, implementation timeframe, and more.
- National Flood Insurance Program (NFIP) Survey: This form was provided to communities to collect information on each community's participation in and continued compliance with the NFIP.
- Community Mitigation Survey: This form was provided as part of the Draft HMP review. Questions focused on an individual's level of knowledge of hazard mitigation, renting or owning insurance and protection, and preference of how to receive information on hazard mitigation.

Figure 3.4-1 The Washington County HMP Project Website



Public and stakeholder participation and comment was encouraged throughout the planning process, particularly through the project website, https://www.pennsylvaniahmp.com/washington-county-hmp. This site was created and made publicly available at the beginning of the planning process and acted as a repository of information for the planning process—providing presentations, agendas, minutes, and worksheets from each meeting as well as promulgating meeting dates, times, and important announcements. The website hosted a Community Mitigation Survey which gathered information about how the public preferred to receive information about risk and hazards as well as data about financial risk protection and interest in continuing education. The site was made publicly available and linked to the County's website. Since the site was published in February 2021, it has received a total of 397 pageviews. In an effort to encourage additional participation and involvement, municipalities have also received emails with document links and updates.

Other methods to encourage participation included utilizing social media and advertising in local venues. Specific examples include using the Washington County Board of Commissioners Facebook page to post information including a flyer to advertise the plan update, and posting the flyer at the local library and other member libraries. More information

on outreach methods can be found in Appendix C – Meeting and Other Participation Documentation.

Washington County posted the 2021 Draft Hazard Mitigation Plan Update on the plan update website (https://www.pennsylvaniahmp.com/washington-county-hmp) for review and comment on June 21, 2021. In addition, an invitation to the public to review and comment on the draft plan was posted on the home page of the project website, in the local newspaper, and on the County's website. Comments were to be submitted via the online comment form or in writing to the HMSC.

3.5. Multi-Jurisdictional Planning

This HMP was developed using a multi-jurisdictional approach. Though County level departments have resources such as technical expertise and data which local jurisdictions may lack; involvement from local municipalities is critical to the collection of local knowledge related to hazard events. Local municipalities also have the legal authority to enforce compliance with land use planning and development issues. The Steering Committee was committed to garnering municipal participation. Table 3.2-2 lists jurisdictional participation in the 2021 HMP. Of Washington County's 66 municipalities, 49 fully participated in the plan update, resulting in 74% participation across the County.

All meetings of both the HMSC and the HMPT were held virtually due to COVID-19 restrictions; for the Kick-Off, Risk Assessment and Mitigation Solutions Workshop, and Draft Plan Review meeting morning and evening sessions were offered to accommodate stakeholder schedules. Each municipality was emailed and mailed invitations and reminders to all meetings. Surveys and forms were posted to the project website or emailed to jurisdictions (in advance of virtual meetings) with a link to online materials.

4. Risk Assessment

4.1. Update Process Summary

To reduce the potential for hazard damage, it is necessary to identify hazards that may affect the County. This risk assessment provides a factual basis for activities proposed by the County in its mitigation strategy. Hazards that may affect Washington County are identified and defined in terms of location and geographic extent, magnitude of impact, previous events, and likelihood of future occurrence. All information from the previous plan has been included or updated in the 2021 Washington County HMP Update, unless otherwise indicated. The Washington County HMPT reviewed the hazards profiled in the 2015 Washington County HMP Update during the March 16, 2021 Kick-Off Meeting. The HMPT determined that all the existing hazards should be carried over into the 2021 plan update and decided that two additional hazards, Pandemic and Opioid Addiction, should be profiled in the 2021 plan update. The hazards selected by the HMPT were then reviewed at the April 27, 2021 Risk Assessment and Mitigation Solutions Workshop. The municipalities completed an Evaluation of Hazards and Risk Form to indicate their jurisdictional risk to each hazard that would be profiled in the 2021 plan. Stakeholders were asked on the Evaluation of Hazards and Risk Form if they would like to add any additional hazards. Responses indicated that there was a need to add three more new hazards for the 2021 update, Utility Interruption, Transportation Incident, and Civil Disturbance.

Hazard profiles in the 2021 HMP include the following Natural and Human-Made Hazards:

- **Drought**
- **Earthquake**
- **Flood, Flash Flood, Ice Jam**
- **Landslide**
- **Pandemic**
- **Radon Exposure**
- **Subsidence, Sinkhole**
- **Tornado and Windstorm**
- **Winter Storm**
- **Dam Failure**
- **Conventional Oil and Gas Wells**
- **Unconventional Oil and Gas Wells**
- **Opioid Addiction**
- **Utility Interruption**
- **Transportation Incidents**
- **Civil Disturbance**

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

Following hazard identification and profiling, a vulnerability assessment was performed to identify the impact of natural hazard events on people, buildings, infrastructure, and the community. Each natural hazard is discussed in terms of its potential impact on individual communities in Washington County, including the types of parcels and critical facilities that may be at risk. The assessment allows the County and its municipalities to focus mitigation efforts on areas most likely to be damaged or most likely to require early response to a hazard event. A vulnerability analysis was performed which identifies structures, critical facilities, or

people that may be impacted by hazard events and describes what those events can do to physical, social, and economic assets. Depending upon data availability, assessment results consist of an inventory of vulnerable structures or populations.

4.2. Hazard Identification

4.2.1. Table of Presidential Disaster Declarations

In the past, natural hazards have led to costly disasters in Washington County resulting in a Presidential Declaration of Major Disaster or a Gubernatorial Proclamation of Extreme Emergency. Presidential Disaster and Emergency Declarations are issued when it has been determined that State and local governments need assistance in responding to a disaster event (Source 8). Table 4.2.1-1 identifies Presidential Disaster and Emergency Declarations issued between 1955 through 2020 that have affected Washington County.

Table 4.2.1-1 Presidential Disaster and Emergency Declarations Affecting Washington County

DECLARATION NUMBER	DATE	EVENT
4506	March 30, 2020	Covid-19 Pandemic
3441	March 13, 2020	Emergency Declaration – Covid-19 Pandemic
3356	October 29, 2012	Hurricane Sandy
3235	September 10, 2005	Hurricane Katrina
3180	February, 2003	Emergency Declaration – Severe Winter Storm
1093	January 21, 1996	Major Disaster Declaration – Severe storms and flooding
1085	January 31, 1996	Major Disaster Declaration - Blizzard of '96
1015	March 10, 1994	Major Disaster Declaration – Severe winter storms
3105	March 16, 1993	Emergency Declaration – Severe snowfall and winter storm
754	November, 1985	Severe Storms, Flooding
3026	January 29, 1977	Emergency Declaration - Snowstorms
340	June 23, 1972	Tropical Storm Agnes

In addition to these Presidentially declared events, 36 events warranted Gubernatorial Disaster Declarations or Proclamations. Table 4.2.1-2 lists Gubernatorial Disaster Declarations or Proclamations that have been issued for Washington County between 1955 and 2021.

Table 4.2.1-2 Gubernatorial Disaster Declarations or Proclamations affecting Washington County.

DATE	EVENT
March 6, 2020	Proclamation of Disaster Emergency – Coronavirus (COVID-19)
August, 2018	Proclamation of Disaster Emergency - Rapid, Heavy Rainfall Resulting in Flash Floods

Table 4.2.1-2 Gubernatorial Disaster Declarations or Proclamations affecting Washington County.	
DATE	EVENT
April, 2018	Proclamation of Emergency - Opioid Crisis, Severe Winter Storms
January, 2018	Proclamation of Disaster Emergency - Opioid Crisis

Washington County has also received Small Business Administration (SBA) Assistance for a number of disaster events. A Small Business Administration Disaster Declaration qualifies communities for access to affordable, timely, and accessible financial assistance. The three County events receiving Small Business Administration disaster-related loan assistance are listed below.

Table 4.2.1-3 Small Business Administration Disaster Declarations Affecting Washington County	
DATE	EVENT
June, 2018	Flooding
September, 2018	Flooding
July, 2019	Flash Flooding

4.2.2. Summary of Hazards

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

Table 4.2.2-1 Hazards Identified in the Washington County 2015 Mitigation Plan Update		
HAZARDS		
Flooding	Winter Weather	Tornado, Windstorm
Drought and Crop Failure	Landslides	Earthquakes
Subsidence, Sink Hole	Dam Failure	Environmental Hazards
	Radon Exposure	

All hazards identified in 2015 plan were included in the 2021 HMP update. The hazards were reviewed by the HMPT at the March 16, 2021 Kick-Off Meeting. Each municipal attendee was provided with an *Evaluation of Hazards and Risk Form* and the PEMA Standard List of Hazards which is a comprehensive list of all hazards to be considered for evaluation in the 2021 plan.

Following review of this hazards list and completion of the *Evaluation of Hazards and Risk Form*, the HMPT determined that five new hazards would be included in the 2021 HMP Update: Pandemic, Opioid Addiction, Transportation Incident, Utility Interruption, and Civil Disturbance. Full hazard profiles were added for Pandemic and Opioid Addiction. Abbreviated hazard profiles were added for Transportation Incident, Utility Interruption, and Civil Disturbance. Also, the Environmental Hazards profile was broken into two individual profiles – one that focuses on Conventional Oil and Gas Wells and another that focuses on

Unconventional Oil and Gas Wells – to reflect the PEMA SOG Standard List of Hazards. The County is interested in collecting additional data on the abbreviated profiles to determine if full profiles may be most helpful. Table 4.2.2-2 contains a complete list of all potential hazards in Washington County identified through the risk assessments and planning meetings. Hazard profiles are included in Section 4.3 for each of these hazards.

Table 4.2.2-2 List and Description of Natural and Human Caused Hazards Profiled in the 2021 Hazard Mitigation Plan Update (PA 2020 Standard Operating Guide)

HAZARD	HAZARD DESCRIPTION
NATURAL HAZARDS	
	Drought is defined as a deficiency of precipitation experienced over an extended period of time, usually a season or more. Droughts increase the risk of other hazards, like wildfires, flash floods, and landslides or debris flows. This hazard is of particular concern in Pennsylvania due to the prevalence of farms and other water-dependent industries, water-dependent recreation uses, and residents who depend on wells for drinking water.
	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.
	Flooding is the temporary condition of partial or complete inundation of normally dry land, and it is the most frequent and costly of all natural hazards in Pennsylvania (PEMA, 2018). Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. (FEMA, 2018). Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams.
	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.

Table 4.2.2-2 List and Description of Natural and Human Caused Hazards Profiled in the 2021 Hazard Mitigation Plan Update (PA 2020 Standard Operating Guide)	
HAZARD	HAZARD DESCRIPTION
	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 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.
	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.
	A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. About 1,250 tornadoes hit the U.S. each year, with about 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.
	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 incidents on icy roads, medical emergencies while shoveling snow, or hypothermia from prolonged exposure to cold.
HUMAN MADE HAZARDS	
	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.

Table 4.2.2-2 List and Description of Natural and Human Caused Hazards Profiled in the 2021 Hazard Mitigation Plan Update (PA 2020 Standard Operating Guide)	
HAZARD	HAZARD DESCRIPTION
	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.
	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.
	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.
	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.
	Transportation incidents are technological hazards involving the nation's system of land, sea, and air transportation infrastructure. A flaw or breakdown in any component of this system can and often does result in a major disaster involving loss of life, injuries, property and environmental damage, and economic consequences.
	Utility interruption 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 and Vulnerability Analysis

NATURAL HAZARDS

4.3.1. Drought

4.3.1.1. Location and Extent

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period, usually a season or more in length. Droughts are a normal part of the climate in the Mid-Atlantic; they are a consequence of a natural reduction in the amount of precipitation experienced over a long period of time. High winds, prolonged winds, and low relative humidity can exacerbate the severity of a drought. Droughts are regional climatic events, so they typically impact all communities in a relatively uniform fashion with only minor localized variations in rainfall events. Droughts often occur across county boundaries, affecting large areas of Pennsylvania at the same time. Therefore, a drought would affect all of Washington County, with the largest impact being on areas of the County with extensive agriculture uses, which accounts for 29% of land use in the County. Figure 4.3.1-1 shows agricultural land use in Washington County. Additionally, areas that heavily forested can also be negatively impacted by drought

Locations of droughts nationwide are monitored continuously by USGS, and the PA DEP monitors conditions throughout the state. 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.

Figure 4.3.1-1 Agricultural Land Use in Washington County

4.3.1.2. Range of Magnitude

Droughts can have varying effects, depending upon what month they occur, severity, duration and location. Some droughts have their greatest impact on agriculture and even short-term droughts, when coupled with extreme temperatures can be devastating. Many of Washington County's residents rely on wells for their water supply. Drought can seriously impact water availability for many Washington County residents. Others may impact water use activities such as recreation, livestock consumption, and irrigation of croplands. Most droughts cause direct impacts to aquatic resources. Drought events are defined by rainfall amounts, vegetation conditions, soil-moisture conditions, water levels in reservoirs, stream flow, agricultural productivity, or economic impacts.

The Commonwealth uses five parameters to assess drought conditions:

1. 1. Stream flows (compared to benchmark records)
2. 2. Precipitation (measured as the departure from normal, 30-year average precipitation)
3. 3. Reservoir storage levels in a variety of locations (especially three New York City reservoirs in upper Delaware River Basin)
4. 4. Groundwater elevations in a number of counties (comparing to past month, past year and historic record)
5. 5. The Palmer Drought Severity Index – 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 (NOAA, 2020)

INDEX	SEVERITY CATEGORY
4.0 more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild Drought
-2.0 to -2.99	Moderate drought
-3.00 to -3.99	Severe drought
-4.0 or less	Extreme drought

In Pennsylvania, PEMA has primary responsibility for managing droughts with direct support from the Department of Environmental Protection (DEP). According to USGS, PEMA and DEP use the following three stages to describe and manage droughts. They are listed 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. Drought Watches are invoked when three or more drought indicators are present for a county or group of counties. 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 use by five percent in the affected areas. Due to varying conditions, individual water suppliers or municipalities may determine 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 use by 10-15 percent in the affected areas. As with a Drought Watch, varying conditions may cause individual water suppliers or municipalities to determine 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 (Pennsylvania Code: Chapter 120, 2018).

Environmental impacts of drought include:

- Hydrologic effects – lower water levels in reservoirs, lakes, and ponds; reduced streamflow; 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.

4.3.1.3. Past Occurrence

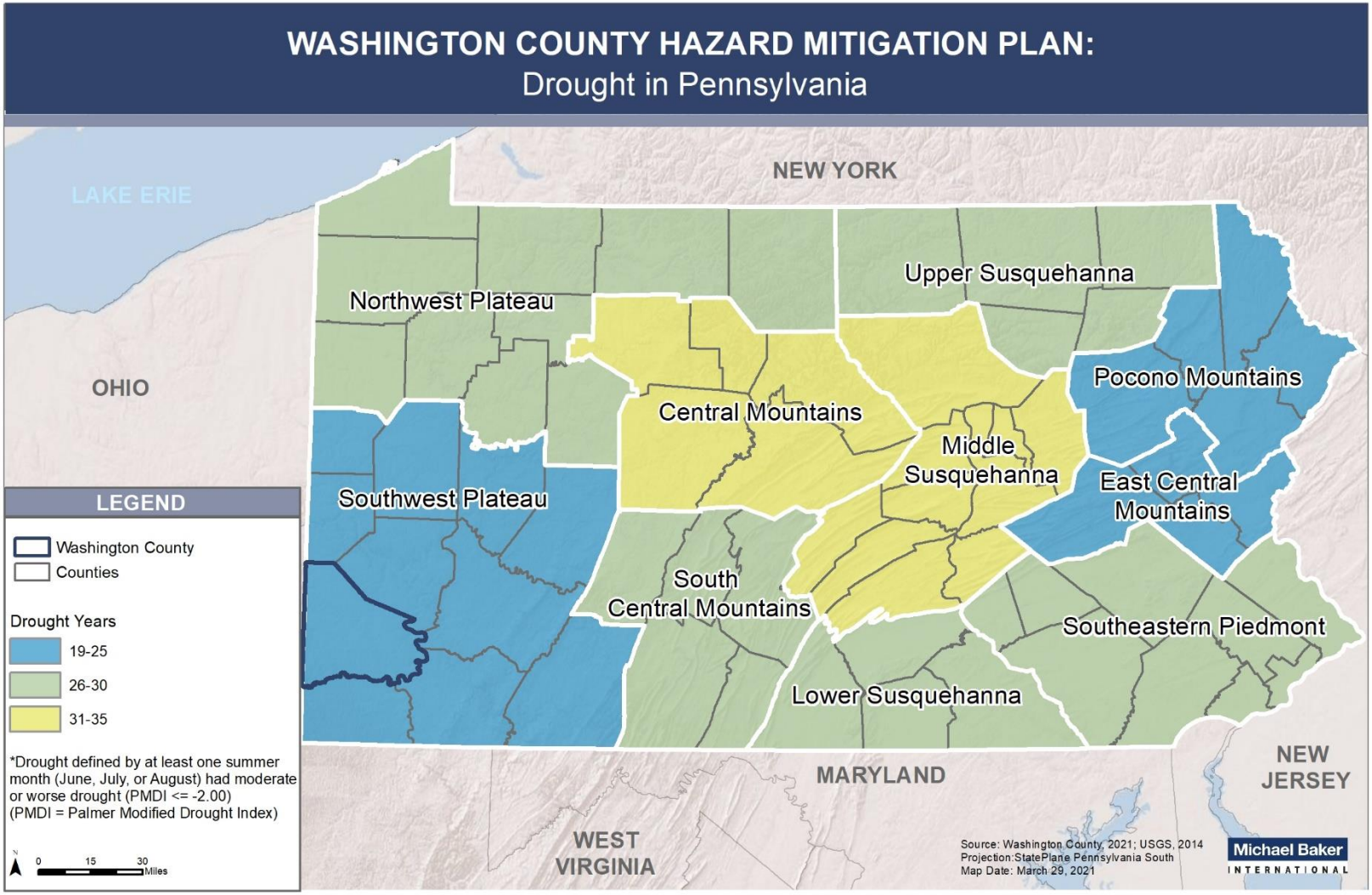
On July 20, 1999, the Governor of Pennsylvania declared a drought emergency in almost all of Pennsylvania including, Washington County, following extended dry weather through much of the summer. Precipitation deficits for the months of May through July averaged between five and seven inches. Precipitation departures for the 365-day period ending in mid-July were more than one foot below normal in many places. This is about one-third of total annual normal precipitation in most areas. Streams were empty and wells dried up. Table 4.3.1-2 lists periods of drought in the Washington County area showing a total of 40 droughts between 1980 and February 2021.

Table 4.3.1-2 Washington County Declared Drought Status From 1980 to 2021 (PA DEP, 2021)

DATE	DROUGHT STATUS
Nov 8, 1982 – Nov 10, 1982	Emergency
Nov 10, 1982 – Feb 8, 1983	Emergency
Jul 7, 1988 - Aug 24, 1988	Watch
Aug 24, 1988 - Dec 12, 1988	Warning
Jun 28, 1991 - Jul 24, 1991	Warning
Jul 24, 1991 – Aug 16, 1991	Warning
Aug 16, 1991 - Sep 13, 1991	Warning
Sep 13, 1991 - Oct 21, 1991	Warning
Oct 21, 1991 - Jan 16, 1992	Warning
Jan 17, 1992 - Apr 20, 1992	Warning
April 20, 1992 – June 23, 1992	Warning
Jun 23, 1992 – Sep 11, 1992	Watch
Sep 1, 1995 - Sep 20, 1995	Watch

Table 4.3.1-2 Washington County Declared Drought Status From 1980 to 2021 (PA DEP, 2021)	
DATE	DROUGHT STATUS
Sep 20, 1995 - Nov 8, 1995	Watch
Nov 8, 1995 - Dec 18, 1995	Watch
Dec 3, 1998 - Dec 8, 1998	Watch
Dec 3, 1998 - Dec 8, 1998	Watch
Dec 8, 1998 - Dec 14, 1998	Watch
Dec 14, 1998 - Dec 16, 1998	Watch
Dec 16, 1998 – Jan 15, 1999	Watch
Jan 15, 1999 – March 15, 1999	Watch
March 15, 1999 – June 10, 1999	Watch
June 10, 1999 – June 18, 1999	Watch
June 18, 1999 – July 20, 1999	Warning
Jan 15, 1999 – March 15, 1999	Watch
March 15, 1999 – June 10, 1999	Watch
June 10, 1999 – June 18, 1999	Watch
June 18, 1999 – July 20, 1999	Warning
Jan 15, 1999 – June 18, 1999	Watch
June 18, 1999 – July 20, 1999	Warning
July 20, 1999 – September 30, 1999	Emergency
September 30, 1999 – February 25, 2000	Warning
February 25, 2000 – May 5, 2000	Watch
September 5, 2002 – June 18, 2003	Watch
April 11, 2006 – June 30, 2006	Watch
August 7, 2006 – January 11, 2008	Watch
November 7, 2008 – January 26, 2009	Watch
September 16, 2010 – November 10, 2010	Warning
November 10, 2010 - December 17, 2010	Watch
July 19, 2012 – August 31, 2012	Watch

Figure 4.3.1-2 Drought Frequency in Washington County From 1900-2021 (PMDI, 2021)



4.3.1.4. Future Occurrence

It is difficult to forecast the severity and frequency of future drought events. Based on data from 1895 to present, Pennsylvania can be divided into ten PDSI areas (see Figure 4.3.1-1). Each of these areas have been assigned a percent of time PDSI values are less than or equal to three, a value equivalent to a drought warning or drought emergency in Pennsylvania. Washington County and the rest of Pennsylvania's Southwest Plateau is in severe or extreme drought approximately 5-9.9 percent of the time, or -3.00 to -3.99 or -4.0 or less on the PDSI. The future occurrence of drought in Washington County can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

According to the PEMA uncertainty regarding the future occurrence of droughts exists due to the potential impacts of climate change. The Pennsylvania Climate Impacts Assessment 2015 Update suggests that the likelihood for drought will *decrease* by the middle of the 21st century as months with above normal precipitation increase but drying of surface soil across the coterminous United States in all seasons is still projected due to enhanced evapotranspiration due to higher temperatures. Climate Central, an independent organization of scientists, predicts that drought intensity will more than double in the region around the City of Pittsburgh by 2050. The group also predicts that warming intensity will double by 2050, and there will be a sharp increase in heatwaves (Climate Central, 2019).

4.3.1.5. Vulnerability Assessment

Drought vulnerability depends on the duration and area of impact. However, other factors contribute to the severity of a drought. Unseasonably high temperatures, prolonged winds, and low humidity can heighten the impact of a drought. Extended periods of drought can lead to lowered stream levels, altering the delicate balance of riverine ecosystems. Certain tree species are susceptible to fungal infections during prolonged periods of soil moisture deficit. Fall droughts pose a particular threat because groundwater levels are typically at their lowest following the height of the summer growing season.

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

Drought has serious implications for the agricultural sector of Washington County's economy. According to the 2017 USDA Census of Agriculture, Washington County has 190,000 acres in 1,760 farms. Major crop items include forage-land used for hay and haylage, grass silage, and greenchop; corn for both grain and sileage; soybeans and vegetables. The market value of all agricultural products sold is nearly $37 million in 2017. Washington County ranks 40th in total market value of agricultural products among counties in the Commonwealth, some or all of this product is at risk during a drought event. Table 4.3.1-3 details the number and value of livestock in Washington County as well as how the County ranks against other counties in

Pennsylvania. Figure 4.2-1 shows the existing land uses in Washington County, and Figure 4.3.1-1 shows how agricultural uses are distributed throughout the County, with the exception of in Washington City and its environs and the Monongahela River towns.

Table 4.3.1-3 Livestock Inventory Washington County

LIVESTOCK TYPE	2017	SALES VALUE	RANK IN STATE
Cattle & Calves	24,220	$7,020,000	28
Sheep & Lambs	5,693	$607,000	7
Horses & Ponies	3,495	$815,000	8
Broilers	805	*	43
Layers	6,804	*	43
**Sales value of Poultry and Eggs not listed by USDA to avoid disclosing data for individual operations.*			

Wildfire is the most severe secondary effect associated with drought. Wildfires can devastate wooded and agricultural areas, threatening natural resources and farm production facilities. Prolonged drought conditions can cause major ecological changes, such as increases in scrub growth, flash flooding, and soil erosion.

Long-term water shortages can have a high impact on agribusinesses, hydropower-dependent utilities, and other industries reliant on water for production services; all critical infrastructure in Washington County is vulnerable to the effects of a drought. Drought can cause municipalities to enforce water rationing and distribution. This strains the availability of consumable water for the community. It also increases Washington County's vulnerability to other hazards such as severe weather, extreme heat, and public health emergencies. The special needs population of any County also must be considered during drought conditions.

Washington County residents that use private domestic wells are also vulnerable to droughts because their wells can dry up. There are 2,038 domestic wells in Washington County, an increase of 98 wells since 2015 (1,940). Table 4.3.1-3 shows the number of domestic wells per municipality as collected by the Pennsylvania Groundwater Information System (PaGWIS). According to this dataset, seventeen municipalities have over 50 domestic wells. Residents in Mount Pleasant Township are the most vulnerable to water supply issues related to droughts with the highest number of wells (207) reported. It is important to note, however, that the well data collected by PaGWIS relies on voluntary submissions of well record data by well drillers; therefore, it may not be a complete database of all domestic wells in the County.

Table 4.3.1-4 Domestic Water Wells in Washington County (PA GWIS 2020)

MUNICIPALITY	**NUMBER OF DOMESTIC WATER WELLS**
Allenport Borough	0
Amwell Township	195
Beallsville Borough	7
Bentleyville Borough	13
Blaine Township	48
Buffalo Township	65

Table 4.3.1-4 Domestic Water Wells in Washington County (PA GWIS 2020)	
Burgettstown Borough	4
California Borough	16
Canonsburg Borough	9
Canton Township	43
Carroll Township	13
Cecil Township	54
Centerville Borough	10
Charleroi Borough	0
Chartiers Township	35
Claysville Borough	2
Coal Center Borough	0
Cokeburg Borough	0
Cross Creek Township	57
Deemston Borough	3
Donegal Township	92
Donora Borough	4
Dunlevy Borough	0
East Bethlehem Township	10
East Finley Township	69
East Washington Borough	0
Elco Borough	0
Ellsworth Borough	0
Fallowfield Township	48
Finleyville Borough	0
Green Hills Borough	0
Hanover Township	43
Hopewell Township	74
Houston Borough	0
Independence Township	37
Jefferson Township	32
Long Branch Borough	12
Marianna Borough	0
McDonald Borough	0
Midway Borough	0
Monongahela City	1
Morris Township	69
Mount Pleasant Township	207
New Eagle Borough	0
North Bethlehem Township	60
North Charleroi Borough	0
North Franklin Township	10
North Strabane Township	53
Nottingham Township	60
Peters Township	46
Robinson Township	30
Roscoe Borough	6
Smith Township	67
Somerset Township	91

Table 4.3.1-4 Domestic Water Wells in Washington County (PA GWIS 2020)	
South Franklin Township	100
South Strabane Township	58
Speers Borough	0
Stockdale Borough	1
Twilight Borough	2
Union Township	18
Washington City	9
West Bethlehem Township	29
West Brownsville Borough	1
West Finley Township	68
West Middletown Borough	19
West Pike Run Township	38
TOTAL	**2,038**

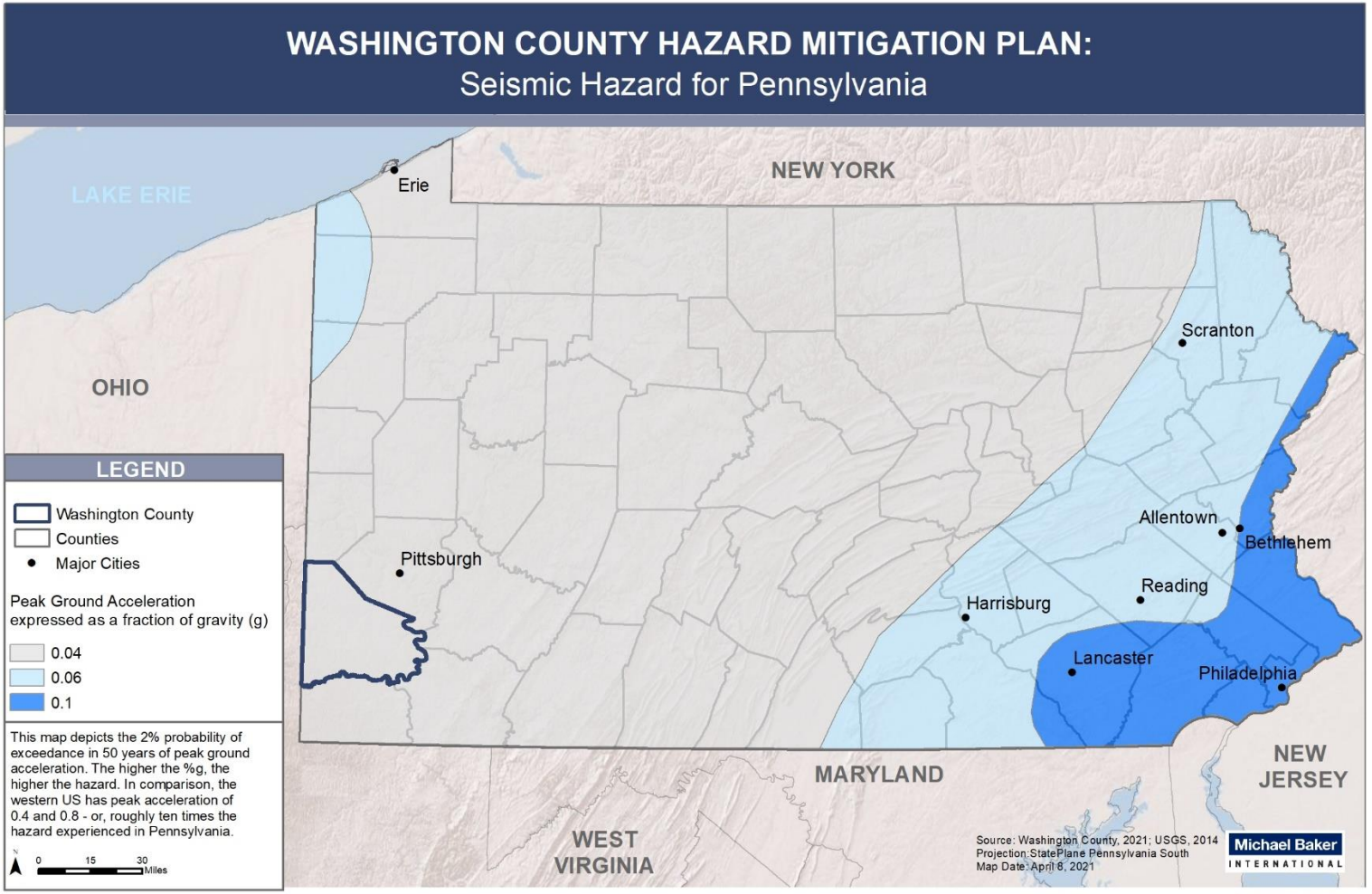
4.3.2. Earthquake

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. As regional hazards, an earthquake would affect all of Washington 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 U.S. and Pennsylvania.

Earthquake events in Pennsylvania typically do not impact areas greater than 100 km (62 miles) from the epicenter, and earthquake epicenters in Washington 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 Washington County, expressed as the two-percent probability of exceedance in 50 years of peak ground acceleration (g). Washington County is in the 0.04 zone indicating that the hazard is slight. However, earthquakes originating outside Pennsylvania can affect Washington County, as was the case with a magnitude 5.8 earthquake in Virginia in August 2011 (see Section 4.3.2.3).

Figure 4.3.2-1 Washington County and Pennsylvania Earthquake Hazard Zones



4.3.2.2. Range of Magnitude

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; the highest known magnitude earthquake occurring within Pennsylvania registered 5.1 on the Richter Scale. Most earthquakes with known magnitudes generally fall between 2 and 3.

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 in areas where people live up to about 100 kilometers across.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

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 (ABAG)

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

Table 4.3.2-2 Modified Mercalli Intensity Scale with Associated Impacts (ABAG)			
SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
VIII	Destructive	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	<6.9
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

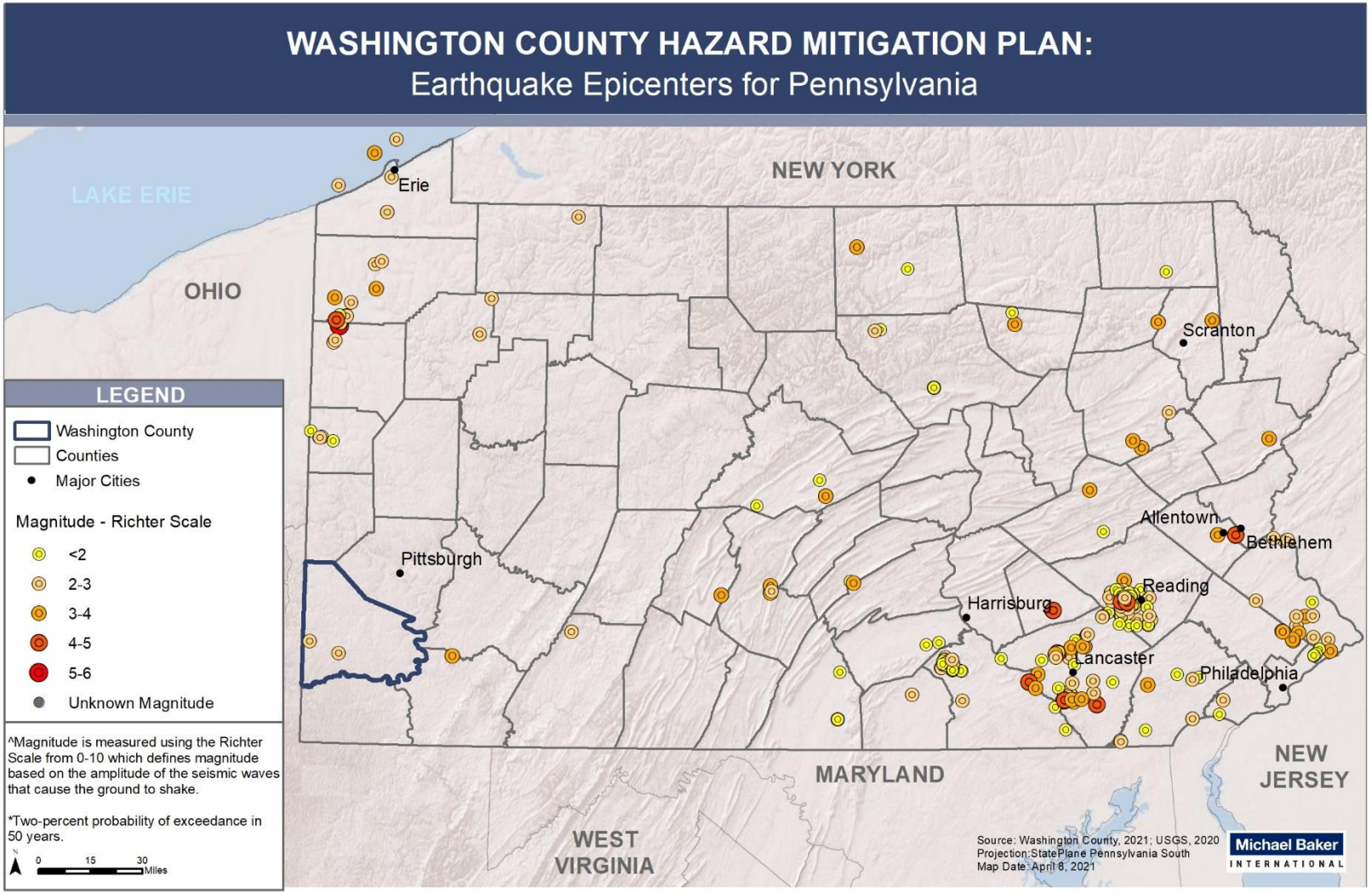
Recent earthquakes in Pennsylvania have been measured from IV to VI on the Modified Mercalli Intensity Scale. However, since the worst earthquake recorded in Pennsylvania was a magnitude 5.2, a worst-case scenario for this hazard would be if an earthquake of similar magnitude occurred in or around Washington County near a populated area. Structural damage would not be expected in this scenario for most buildings, but blighted structures or those in a state of disrepair might experience further structural damage.

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 Washington County.

4.3.2.3. Past Occurrence

According to records from USGS, there have been two earthquake recorded with its epicenter in Washington County. Both were recorded as having a magnitude of 2-3 on the Richter Scale. 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.

Figure 4.3.2-2 Washington County and Pennsylvania Earthquake Epicenters



4.3.2.4. Future Occurrence

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak ground acceleration (PGA) measures the strength of ground movements in this manner. PGA represents the rate in change of motion of the earth's surface during an earthquake as a ratio of the established rate of acceleration due to gravity. As shown in Figure 4.3.2-1, Washington County has a very low PGA ratio of 0.04. In contrast, the western United States has a peak ground acceleration ten times that of Washington County.

Washington County does not sit on any fault lines and historical records indicate that the future likelihood is low; 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 Washington 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.

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 Washington County due to earthquake, damages are estimated to be limited to the more dilapidated structures and structures with unreinforced masonry. Nearly 60% (55,140) of housing structures in Washington County are at least 50 years old and over 25% (25,598) of all structures were built prior to 1940 (U.S. Census Bureau, 2020).

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.

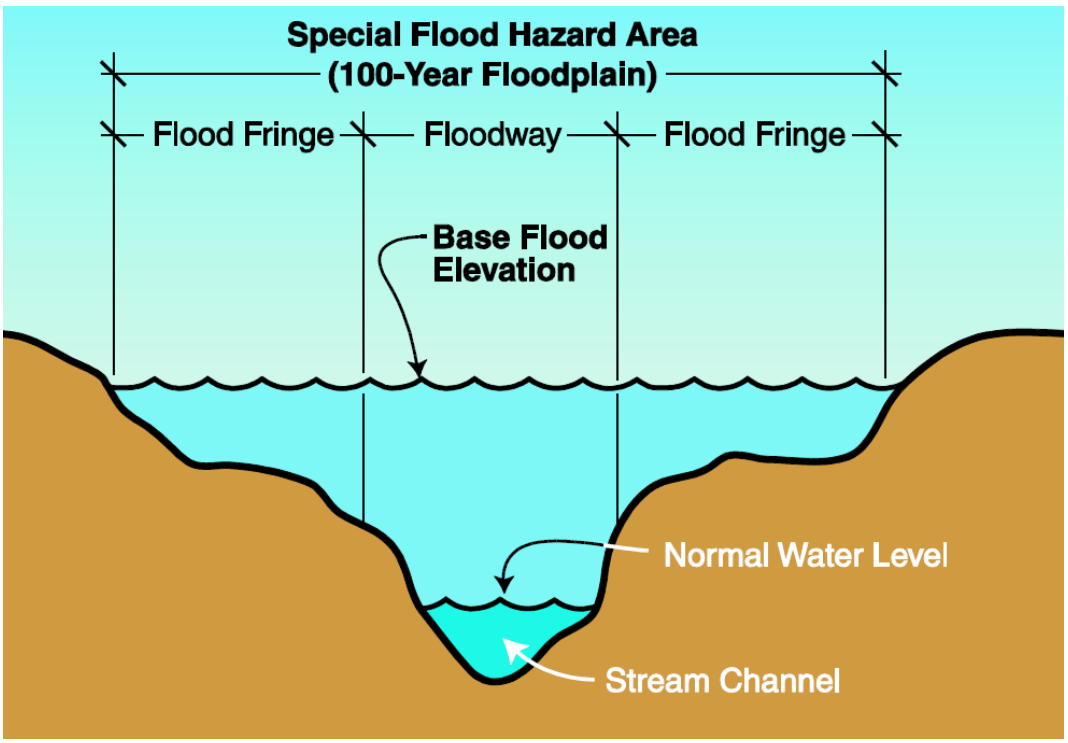
4.3.3. Flood, Flash Flood, Ice Jam

4.3.3.1. Location and Extent

A flood is a natural event for streams and rivers. 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. 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 flood that has a 10 percent chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2% annual chance of occurring.

The National Flood Insurance Program (NFIP), for which Flood Insurance Rate Maps (FIRM) are published, identifies the 1% annual chance flood. This 1% annual chance flood event is used to delineate the Special Flood Hazard Area (SFHA) and identify Base Flood Elevations. Figure 4.3.3-1 illustrates these terms. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth of Pennsylvania and Washington County local governments.

Figure 4.3.3-1 Diagram Identifying Special Flood Hazard Area, 1% Annual Chance (100-Year) Floodplain, Floodway and Flood Fringe



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. This is not a significant factor in Washington County; however, snowmelt during sudden winter thaws or in early spring has been recorded in some instances (FEMA, 2015).

Washington County lies within the drainage basin of the Ohio River, which has a drainage of 23,487 square miles in Pennsylvania. Rivers, streams, and tributaries in the northern and western portions of the County drain directly into the Ohio River. Watercourses in the eastern and southern sections of Washington County drain into the Monongahela River, which empties into the Ohio River in Pittsburgh. The Monongahela River Watershed has a drainage basin of 7,386 square miles and is located within the Ohio River Watershed (WCPC, 2005).

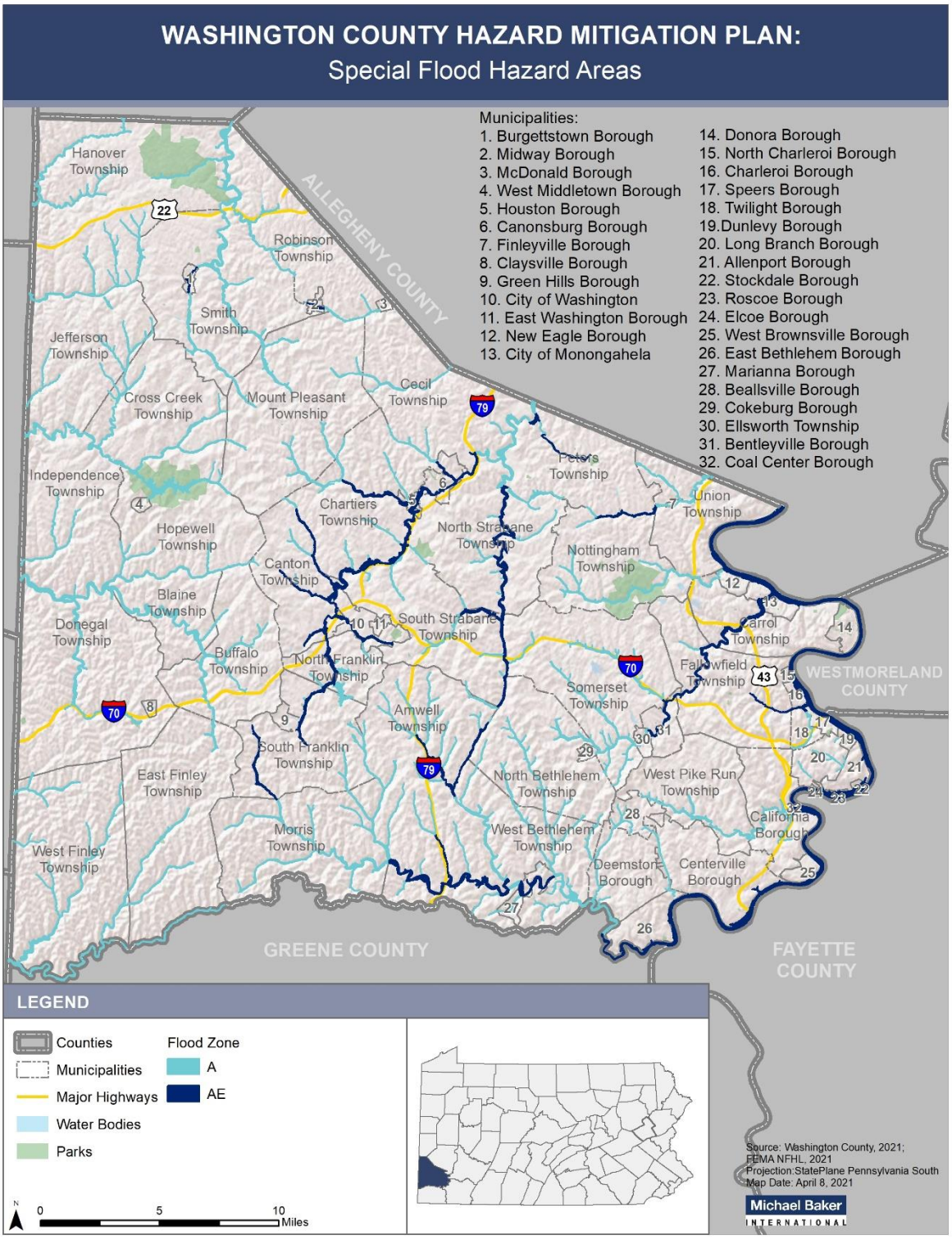
For areas like southwestern Pennsylvania, excess water from snowmelt or rainfall accumulates and overflows onto the stream banks and adjacent floodplains. Waterways susceptible to flooding in Washington County tend to flow in narrow valleys sided by steep slopes. This geography is conducive to rapid runoff during rainstorms. Brush Run, Chartiers Creek, Chartiers Run, Little Chartiers Creek, and Maple Creek all experience flooding from this (FEMA, 2015).

The Washington County Act 167 Stormwater Management Plan lists problem areas throughout the County identified through information request forms for municipalities. Communities with several flooding problem areas and obstructions due to stormwater management issues include Bentleyville Borough, Burgettstown Borough, California Borough, Canonsburg Borough, Cecil Township, Claysville Township, Cross Creek Township, East Finley Township, Hanover Township, Mount Pleasant Township, New Eagle Borough, North Strabane Township, Robinson Township, Roscoe Borough, South Franklin Township, South Strabane Township, the City of Washington, and West Brownsville Borough (WCPC, 2010).

Washington County has FEMA effective Flood Insurance Rate Maps and a Countywide Flood Insurance Study. This study was conducted as a part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) process and went effective on September 30, 2015. The purpose of the Risk MAP program is to assist communities nationwide to assess flood risk, encourage mitigation planning, and to strengthen local ability to make informed decisions about risk reduction. Individual map panels can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov). These maps can be used to identify the expected spatial extent and elevation of flooding from a 1% and 0.2% annual chance event.

Note that McDonald Borough is in both Allegheny County and Washington County. It is included in its entirety in the Allegheny County FIRM and FIS, which were published on September 26, 2014. All but two municipalities in the County have identified special flood hazard areas (SFHAs). The Boroughs of Claysville and East Washington do not have identified SFHAs (FEMA, 2015). Figure 4.3.3-3 shows the location of approximate and detailed (includes BFEs) SFHAs in Washington County.

Figure 4.3.3-2 Locations of Watercourses and Flood Zones Throughout Washington County



Chartiers Creek and the Monongahela River watersheds are Washington County's major high-risk flood areas. Other waterways identified for principal flood problems include Brush Run, Chartiers Run, Little Chartiers Creek, Little Tenmile Creek, Maple Creek, Montgomery Run, Pigeon Creek, Racoon Creek, Robinson Run, and Tenmile Creek. No historical flood data is available for Catfish Creek, Georges Run, Long Pile Run, and Wolfdale Run; however, these streams are more susceptible to flash flooding from intense, short duration summer storms (FEMA, 2015). Reference Figure 2.1-2 and Figure 2.1-3 in Section 2 Community Profile to identify the HUC 10 and HUC8 watershed boundaries in the County.

The County is susceptible to flooding, 51% of the flood susceptible housing stock is located in the Chartiers Creek and Monongahela River watersheds. Other watersheds that have experienced significant flooding are Cross Creek, Pigeon Creek, and Ten-Mile Creek. Washington County has some limited levees located along Chartiers Creek, near the City of Washington and in Peters Township. Only the South Strabane Sewage Treatment Dike has a designated levee protected area. However, the levee system is currently non-accredited, meaning it does not meet the requirements in the NFIP regulations at Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44CFR§65.10), Mapping of Areas Protected by Levee Systems, and is not shown on a FIRM as reducing the base flood hazard (USACE, 2021a).

Small stream flooding has been an ongoing problem within Washington County for decades. Development, stream channel erosion, poor floodplain management, and a general lack of stormwater management regulations have contributed to increased frequency and severity of small stream flooding.

Chartiers Creek has a history of flooding Houston Borough and Chartiers Township. Canonsburg Borough was also affected prior to the Army Corp of Engineers stream dredging and widening project completed in the early 1970s. There are still some low-lying areas of Canonsburg that occasionally suffer from basement flooding following particularly intense storms.

Houston Borough frequently incurs flood damage, ranging from nuisance flooding through major structural damage. During the late 1980s, an isolated thunderstorm resulted in a flashflood on Chartiers Creek in Houston Borough. The flood waters trapped a circus, with all its animals and performers on the American Legion picnic grounds, severely damaged several businesses, and flooded dozens of homes. In the middle of town, floodwaters caused a short circuit in the basement of a commercial building. The ensuing fire heavily damaged the building, and businesses located within. Fire Department response was compromised because of the high water surrounding the burning building.

The US Army Corps of Engineers finalized a flood study in 2021 of Catfish and Chartiers Creek from the City of Washington to the County line in Peters Township. Members of the HMSC

and applicable municipalities were able to attend the Final Results presentation on April 4, 2021. Municipalities also noted the work done as part of the study in their mitigation action updates.

Pigeon Creek also has a history of flooding, which is caused entirely by backwater from the Monongahela River. Areas of Bentleyville, Fallowfield Township, Carroll Township, and Monongahela are normally affected.

A number of factors contribute to the high percentage of flood prone areas in Washington County:

- Washington County topography is characterized by moderately steep slopes. Over sixty percent of its slopes have a gradient in excess of 16 percent (WCPC, 2007).
- Washington County exhibits a humid continental type of climate and receives an average of 34.8 inches of precipitation annually (US Climate Data, 2021).
- Washington County has 1,121 miles of streams and 40 miles of river.
- Washington County contains fifteen watersheds. Three of them considered major watersheds (WCPC, 2005).
- Washington County is Pennsylvania's 18th largest County according to population. In 2019, the County numbered 207,212 persons (US Census, 2019).
- In 2019, Washington County had 95,934 housing units with a vacancy rate of only 11.5% (US Census, 2019).

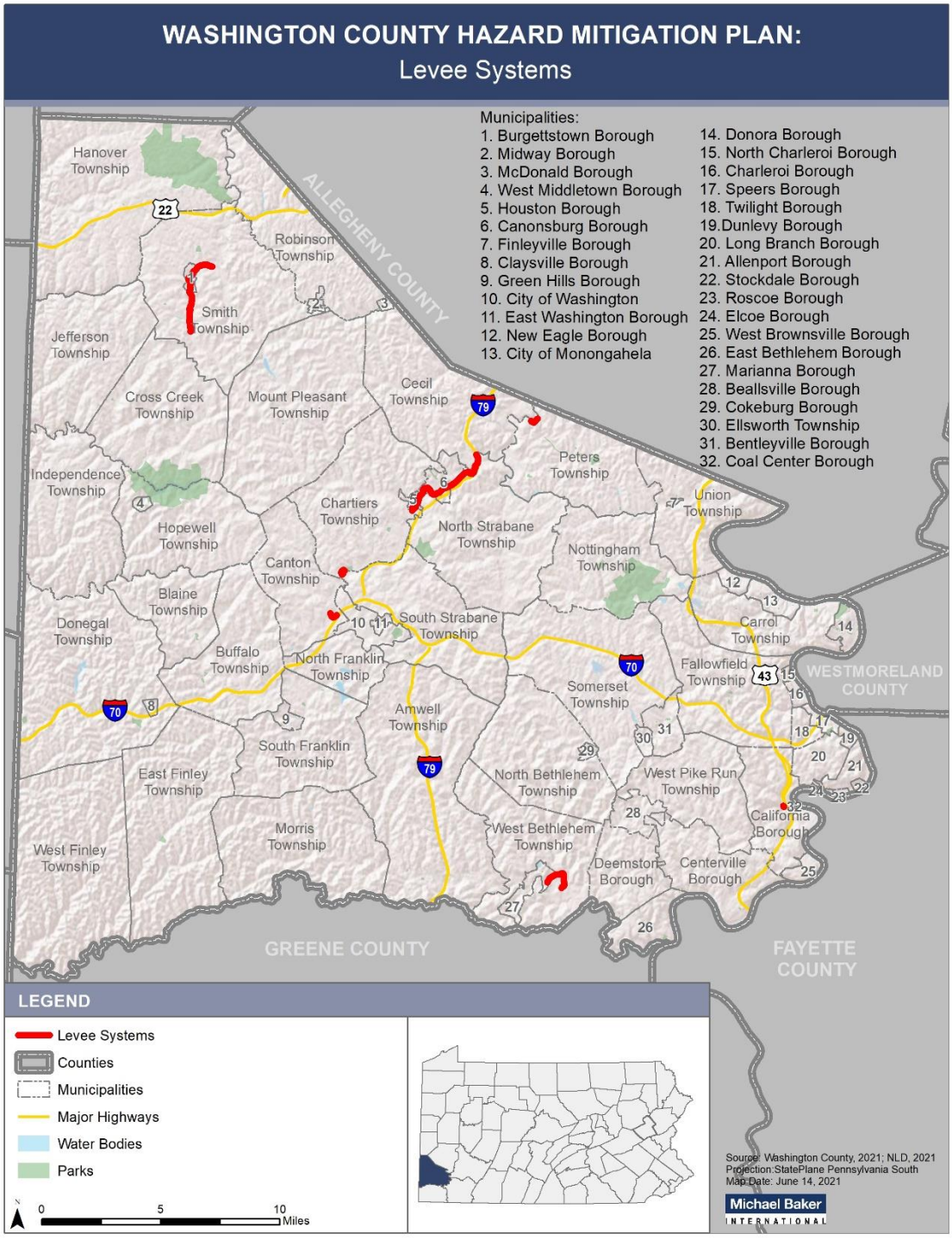
It should also be noted that flooding is not only caused by heavy rain events. Additionally, as described in the Dam Failure Hazard Profile (Appendix H), there are 41 state regulated, high-hazard dams located within the County. If any one of these dams were to fail, there could be loss of life and property damage resulting from flooding within the dam inundation areas.

Flood risk is also associated with levee failure. There are nine levee systems in Washington County, listed in Table 4.3.3-1 below. The United States Army Corps of Engineers (USACE) analyzes levees for flood risk, populations and structures behind them, and potential for inundation. Most levees in Washington County have not yet been screened by USACE. Two of the levees that have been screened have received a low risk rating – Granville – Right Bank Gorby Run and Washington, PA – Left Bank Chartiers Creek. A low risk rating indicates that the likelihood of inundation due to breach and/or system component malfunctions in combination with loss of lie, economic, or environmental consequences is low. Actions to undertake for low risk levees include verifying risk information is current, implementing routine monitoring programs and interim risk reduction measures as needed, assuring Operations and Management is up to date, communicating risk characteristics to the community, verifying emergency plans and flood inundation maps are current, ensuring community is aware of flood warning and evacuation procedures, and recommending the purchase of flood insurance.

Table 4.3.3-1 Levee Systems in Washington County (USACE, 2021b)

LEVEE SYSTEM	PRIMARY FLOOD SOURCE(S)	COMMUNITIES	PROPERTY VALUE BEHIND LEVEE
Burgettstown	Burgetts Fork	Burgettstown Borough, Smith Township	Not screened
Canonsburg	Chartiers Creek	Canonsburg Borough, Chartiers Township, North Strabane Township, Houston Borough, Cecil Township	Not screened
Cecil-Chartiers Creek Levee	Chartiers Creek	Cecil Township	$2.99 M
Granville - Right Bank Gorby Run	Gorby Run, Pike Run	California Borough	$335K
Marianna	Daniels Run, Tenmile Creek	Marianna Borough, West Bethlehem Township	Not screened
Slovan	Burgetts Fork	Burgettstown Borough, Smith Township	Not screened
South Strabane - Sewage Treatment Plant Dike	Chartiers Creek	South Strabane Township	$18.9 M
Washington System	Chartiers Creek	Canton Township	Not screened
Washington, PA - Left Bank Chartiers Creek	Chartiers Creek	Canton Township	$111 M

Figure 4.3.3-3 Levee System in Washington County



4.3.3.2. Range of Magnitude

Nationwide, hundreds of floods occur each year, making them one of the most common hazards in all 50 states and U.S. territories. In Pennsylvania, flooding occurs commonly and can happen during any season of the year from a variety of sources. Every two to three years, serious flooding occurs along one or more of Pennsylvania's major rivers or streams, and it is not unusual for this to occur several years in succession.

Flooding in Washington County has mainly been caused by heavy rainfall. Some areas have experienced rain events bringing three to seven inches of rain to the area within a day. In Washington County, there are seasonal differences in how floods are caused. The region's main flood season is December through April. 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. Winter floods also have resulted from runoff of intense rainfall on frozen ground, and local flooding can be exacerbated by ice jams in rivers, streams, and creeks. Ice jam floods occur on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur. 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. The County occasionally experiences intense rainfall from tropical storms in later 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. Flood damages and elevations can increase due to floating debris such as trees, logs, and brush which restrict the flow of water through the channel, culverts, and bridges. Both culvert and bridge washouts can cause damage to transportation infrastructure, making response and recovery actions more difficult.

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. Washington County has sloping terrain throughout many parts of the County, which 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 building and pavement or a lack of appropriately sized flood water detention basins leads to localized flooding. This type of flooding and extensive damages occurs within the City of Washington and in the surrounding area where there is more development and vehicular movement.

Flood effects can be volume or force related. Major floods along larger streams having wide floodplains tend to result in large-scale inundations. This causes widespread damage through soaking and silt deposits in homes, businesses, and industrial plants. In hilly regions where runoff paths are steep, flash floods may be prevalent. Flash floods are short in duration and usually occur in a somewhat localized area. In these floods, the velocity rather than the volume of water causes flood damages. Torrents of water can rush down minor hillside gullies at 30-50 miles per hour, carrying trees, debris, and rocks. Frozen surfaces can more than double normal runoff velocities, particularly in small drainage areas. This causes flash floods which can be compounded by ice and debris jams in channels and culverts. Obstructions within the floodplain such as bridges and undersized culverts can also increase flooding.

The worst stream flooding in recorded history occurred in September 2004 in the aftermath of Hurricane Ivan. The closest Hurricane Ivan came to Washington County was 300 miles as a tropical depression. The ensuing flood resulted in the structural damage listed in Table 4.3.3-2.

Table 4.3.3-2 Hurricane Ivan Damages in Washington County

STRUCTURE TYPE	# OF STRUCTURES IMPACTED				
	AFFECTED	MINOR DAMAGE	MAJOR DAMAGE	DESTROYED	TOTAL
Businesses	201	74	54	4	**234**
Manufactured homes	65	9	3	100	**177**
Multi-Family Residential	7	21	8	1	**37**
Single-Family Residential	435	240	90	25	**790**
TOTAL	**609**	**344**	**155**	**130**	**1,238**

Rain from the remnants of Hurricane Ivan started during the night of September 16, 2004 and continued into the evening of the 17th. Roads flooded in Canonsburg and Washington. There was widespread stream flooding in Burgettstown, Houston, McDonald, and Midway. Routes 50 and 980 in Avella and Cecil were flooded. Mud slides occurred in the evening in Peters Township, which had 4" of rain. By 8 pm on the 17th, the storm dropped 5" of rain on Washington and 5.9" on Canonsburg. Towns hardest hit included Avella, Burgettstown, Cecil, Independence, Peters, and Washington. Many roads closed by mud slides or flood waters. A trailer park in Canton washed away. Some trailer park residents were trapped atop their manufactured homes until dark, asking for help by signaling SOS with their flashlights. Other manufactured homes were destroyed.

Additional structural damages included houses lifted off foundations, railroad track beds washed away, several roads washed out, and a destroyed grocery store. In addition, 11 boats docked in Millsboro were damaged. In the aftermath of Ivan, FEMA provided over two million dollars in Public Assistance to the affected municipalities in Washington County to repair damaged roads, public buildings, and other critical infrastructure. FEMA provided over seven million dollars in individual assistance.

Although floods can cause damage to property and loss of life, floods are naturally occurring events that benefit riparian systems which have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient rich sediment improving soil fertility. However, the destruction of riparian buffers, 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 in Washington County. There are 85 dams in the County; however, 41 of these are high hazard dams. Please refer to the Dam Failure hazard profile in Appendix H for more information on dams. As previously mentioned, there are nine levee systems in the County.

Since 2015, some municipalities have made progress on flood mitigation or protection projects. Donora Borough completed repairs to storm water pipes that go towards the river. The pipes were lined and opened to allow better flow, and to reduce flood risk. Watershed organizations throughout the County maintain the regions waterways by cleaning creeks and performing streambed restorations as appropriate. Morris Township notes creek cleanings are performed regularly in their jurisdiction. North Franklin Township is in the process of conducting streambank restoration with the Washington County Watershed Alliance.

4.3.3.3. Past Occurrence

Washington County has a long history of flooding problems. Chartiers Creek has a recorded history of flooding from the 1880s. Major floods have been recorded in September 1912, August 1956, April 1961, March 1963, February 1966, and September 2004. The flood in September 1912 was the result of severe thunderstorms which dropped about 6 inches of rain. Swollen streams caused extensive damage to residences and businesses. Many bridges were either damaged or washed away. The costliest of these was the 1956 flood, which caused damages upwards of $1,140,000 in Canonsburg Township (FEMA, 2015).

During the winter of 1996, unseasonably high temperatures began to melt an immense snowpack that had accumulated during the "Blizzard of 1996." Accompanying heavy rainfall and high winds carried large volumes of runoff, overwhelming small and large watersheds.

Before the week was over, all 67 of Pennsylvania's counties had been declared federal disaster areas. The Upper Ohio River Basin saw flooding on the Allegheny, Clarion, Conemaugh, Monongahela, Cheat, Youghiogheny and the Upper Ohio River. Runoff estimates from the snow melt on January 18th and the rainfall that fell on January 19th was between 2.50 and 3.00 inches over the two-day period across much of the area.

In some of the more mountainous areas, runoff was estimated as high as 4.50 inches in a 24-hour period. These totals exceed the normal precipitation amount for the entire month of January. The Monongahela River, as measured at the Charleroi Lock and Dam, crested at 39.80 feet. Flood stage in this area is 28 feet, and major flood stage at this measuring point is 35 feet.

Floods on the Monongahela River usually occur between December and March. Floods in 1941 and 1956 resulted from widespread thunderstorms with high-intensity rainfall. Flooding in October 1954 was caused by intense rainfall of relatively short duration from Hurricane Hazel. Flooding lasted several days. The highest recorded crest at this point of the Monongahela is 44.7 feet, in 1985 (FEMA, 2015). Table 4.3.3-3 lists major flood events on the Monongahela River from the late 1800s through the early 2000s.

Table 4.3.3-3 Major Monongahela River Flood Events (FEMA, 2015)

DATE	CREST 26' Flood Stage
April 6, 1852	33.9
January 10, 1862	33.95
August 3, 1875	31.2
January 17, 1877	32.11
July 18, 1886	37.1
July 18, 1888	35.6
February 23, 1897	37.1
March 14-15, 1907 (Ides of March)	42.5
Sunday, March 30, 1924	32.4
March 17, 1936 (St. Patrick's Day)	40.1
Wednesday, March 25, 1936	36
Saturday, April 19, 1952	34
Tuesday, March 5, 1963	33.8
March 7, 1967	39.7
June 24, 1972 (Hurricane Agnes)	35.4
Friday, January 27, 1978	34.2
Monday, February 26, 1979	31.6
November 5, 1985 (Election Day)	44.7
January 20, 1996	39.8
Saturday, February 19, 2000	38.5
Thursday, November 20, 2003	31.4

The NOAA NCEI records flooding events in the Storm Events Database. Table 4.3.3-4 below lists flooding-related events that have impacted Washington County since 1996 since the NCEI only started recording flood related events in 1996. Detailed descriptions of some of the more significant flooding events that have impacted Washington County over the past decade are also included below. Common impacts include flooded roadways, trapped motorists, and damage to structures in low-lying areas. Reported property damages are estimates reported to the NCEI and displayed in the Storm Events database today. A zero-dollar amount may not necessarily mean there was zero property damage or crop damage, but that it could have been simply not reported. Between 1996 and February 2021 there were 102 flood related events reported to the NCEI in Washington County. Amongst these events, no injuries were reported, and one death was reported in a May 1997 flood. Crop damage was only reported for one flash flood event in March 2020; it accounted for $1,000 in damage (NOAA NCEI, 2021).

Heavy rain led to flash flooding in August 2013 in parts of Washington County. Many roads throughout the area were flooded. State officials reported that Rutan Rod in Ellsworth had at least three feet of water over the roadway (NOAA NCEI, 2021).

Unusually strong wind patterns for the season produced torrential rainfall in July 2017. Washington County was one of the hardest hit areas in the region. Rainfall between two and five inches was reported in most areas. Many roadways in the County were flooded, especially along I-70 and other low-lying areas. The storm caused a landslide onto I-70 east of the City of Washington. At least six vehicles were stranded on flooded roadways in the City. There were also reports of people stuck in their homes due to high water in several parts of the County. The North Franklin Township Volunteer Fire Department responded to 25 flooding calls (NOAA NCEI, 2021).

Heavy rain led to flash flooding in June 2018. Numerous roads were reported flooding. There were some instances of creek overflows and residential basement flooding. At least four motorists were stranded on flooded roads in Washington County and required rescue (NOAA NCEI, 2021).

In September 2018, Tropical Storm Gordon flooded several areas throughout the region. Rainfall occurred for 72 hours straight, dropping between two and seven inches across southwest Pennsylvania. In Washington County numerous roads and basements were flooded; photos show stagnant water was around one foot deep. Camp Ground Road in Independence was closed due to piped being washed out onto the roadway. A bridge in West Pike Run Township washed out. Disaster Declarations were called in several counties, making homeowners, renters, and businesses eligible for post disaster loans. The U.S. Small

Business Administration awarded low-interest loans to qualifying victims of flooding (NOAA NCEI, 2021).

Heavy rainfall in October 2019 caused flooding in Burgettstown. Gusts between 45 to 50 MPH were observed, with many reports of tree and power line damage. Power outages numbered into the thousands of customers across the southwestern Pennsylvania region. In Washington County, a retention pond was reported overflowing on SR 18, a pharmacy flooded, and the Fire Department found several clogged drains (NOAA NCEI, 2021).

Heavy rain and thunderstorms in March 2020 caused flash flooding in several areas of the County including East Washington, Lincoln Hill, Linden, and Vienna. Wind shear increased to 70 knots and hail was reported in some areas. Flooding was reported along several roadways; one vehicle was trapped in the floodwaters and the driver required rescue (NOAA NCEI, 2021).

Table 4.3.3-4 Flood and Flash Flood Events Reported From 1996 to February 2021 (NOAA NCEI, 2021)

LOCATION	DATE	TYPE	PROPERTY DAMAGE ($)
City of Washington	1/19/1996	Flash Flood	$10,000
Countywide	1/19/1996	Flood	$1,400,000
Countywide	2/28/1996	Flash Flood	$5,000
Westland	5/9/1996	Flash Flood	$0
Countywide	5/18/1996	Flood	$0
McDonald, Midway	6/18/1996	Flash Flood	$5,000
Bentleyville	6/24/1996	Flash Flood	$1,000
Countywide	7/20/1996	Flood	$5,000
Countywide	3/2/1997	Flood	$0
Claysville, East Finley, Ginger Hill, Washington	5/19/1997	Flash Flood	$3,000
Chartiers Creek	5/25/1997	Flash Flood	$1,000
West Brownsville	1/9/1998	Flash Flood	$0
Washington	6/26/1998	Flash Flood	$20,000
Southern Portion	6/27/1998	Flash Flood	$100,000
Claysville	6/30/1998	Flash Flood	$25,000
Countywide	8/24/1998	Flood	$10,000
Burgettstown	4/9/1999	Flash Flood	$0
Countywide	2/19/2000	Flood	$2,000,000
Countywide	2/19/2000	Flash Flood	$20,000
Bavington, Burgettstown	7/28/2000	Flash Flood	$5,000
McMurray, Washington	8/6/2000	Flash Flood	$0
Countywide	8/7/2000	Flash Flood	$500,000
Washington	7/10/2001	Flash Flood	$10,000

Table 4.3.3-4 Flood and Flash Flood Events Reported From 1996 to February 2021 (NOAA NCEI, 2021)			
LOCATION	DATE	TYPE	PROPERTY DAMAGE ($)
California	8/10/2001	Flash Flood	$10,000
Charleroi	3/21/2002	Flash Flood	$5,000
Countywide	3/26/2002	Flood	$50,000
West Bornwsville	5/9/2002	Flash Flood	$500,000
Charleroi	6/13/2002	Flash Flood	$3,000,000
California, Deemston	2/23/2003	Flash Flood	$0
Countywide	2/24/2003	Flood	$0
Cecil, Bentleyville, Finleyville, McMurray	5/10/2003	Flash Flood	$0
McMurray, Washington	6/20/2003	Flash Flood	$5,000
McDonald	7/10/2003	Flash Flood	$0
McMurray	8/4/2003	Flash Flood	$0
McMurray	8/27/2003	Flash Flood	$0
McMurray, Washington	11/19/2003	Flash Flood	$0
Countywide	11/19/2003	Flood	$0
Avella, Van Voorhis	12/10/2003	Flash Flood	$0
Countywide	1/3/2004	Flood	$0
Countywide	1/4/2004	Flood	$0
Monongahela	2/3/2004	Flash Flood	$30,000
Countywide	2/6/2004	Flood	$0
Countywide	2/7/2004	Flood	$5,000
Countywide	4/14/2004	Flood	$7,000
Countywide	6/14/2004	Flood	$100,000
Burgettstown	6/15/2004	Flash Flood	$6,000
Countywide	9/8/2004	Flood	$25,000
Countywide	9/17/2004	Flood	$5,130,000
Countywide	1/6/2005	Flood	$500,000
Countywide	1/12/2005	Flood	$0
Countywide	3/29/2005	Flood	$0
Washington	6/6/2005	Flash Flood	$10,000
Beallsville	6/30/2005	Flash Flood	$30,000
McMurray	8/8/2005	Flash Flood	$30,000
Washington	3/15/2007	Flood	$0
Washington	3/23/2007	Flash Flood	$0
Washington	7/5/2007	Flash Flood	$10,000
Allenport, Ellsworth	8/9/2007	Flash Flood	$150,000
Monongahela	5/5/2009	Flood	$150,000
Wolfdale	3/10/2011	Flood	$5,000
Bissel, Tylerdale	4/5/2011	Flood	$55,000

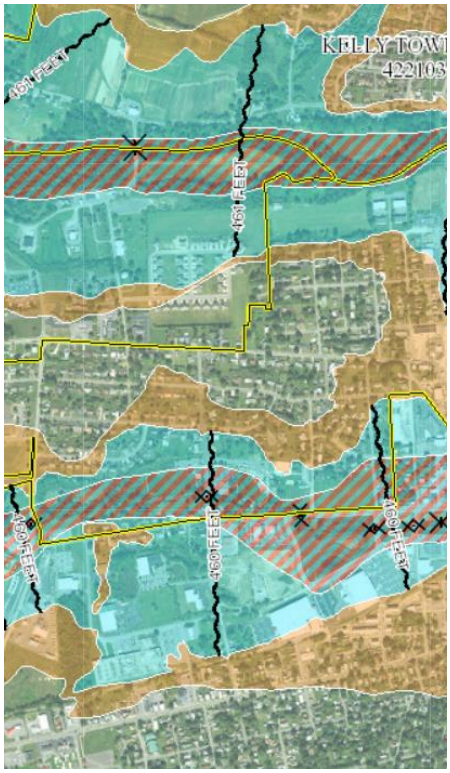
Table 4.3.3-4 Flood and Flash Flood Events Reported From 1996 to February 2021 (NOAA NCEI, 2021)			
LOCATION	DATE	TYPE	PROPERTY DAMAGE ($)
Muse, Vestaburg	5/13/2011	Flood	$25,000
Claysville	5/18/2011	Flood	$5,000
Countywide	6/20/2011	Flood	$200,000
Gastonville	8/19/2011	Flood	$40,000
Budaville, Pleasant Grove	6/18/2012	Flash Flood	$10,000
Washington	10/30/2012	Flood	$50,000
Washington	6/28/2013	Flash Flood	$5,000
Charleroi, Lawrence Hills, McMurray, Midway, Strabane	7/10/2013	Flash Flood	$65,000
Bentleyville	7/16/2013	Flood	$15,000
Allenport, Centerville, Ellsworth, Roscoe	8/23/2013	Flood	$0
Lawrence Hills	5/27/2014	Flood	$1,000
Cecil	3/4/2015	Flood	$0
Hackney	7/6/2015	Flood	$0
Glennes Heights, Tylerdale	7/30/2016	Flood	$40,000
Vanceville	8/28/2016	Flood	$5,000
Denningsville	12/18/2016	Flood	$25,000
Lone Pine, West Alexander	3/1/2017	Flood	$15,000
Gastonville, Wickerham Manor	6/14/2017	Flash Flood	$0
Budaville, Gabby Heights	6/23/2017	Flash Flood	$0
Finleyville	7/6/2017	Flash Flood	$0
Charleroi, Washington	7/23/2017	Flood	$0
Jewell	7/23/2017	Flash Flood	$0
Gabby Heights, Gastonville, Kammerer, Tylerdale Junction, Washington, Wolf Dale	7/28/2017	Flash Flood	$112,500
Monongahela	7/29/2017	Flash Flood	$0
Coal Bluff, McDonald, Strabane, Venice, Washington	1/12/2018	Flood	$0
California, McGovern	2/15/2018	Flood	$0
Gabby Heights	2/16/2018	Flood	$0
Bissell	4/16/2018	Flood	$0
McDonald	6/8/2018	Flash Flood	$0
McDonald	6/8/2018	Flood	$0
Finleyville, Gastonville, Ginger Hill, Lincoln Hill, Thomas, Van Voorhis, Washington	6/10/2018	Flash Flood	$0
Buffalo, Hickory, McMurray	6/20/2018	Flash Flood	$15,000

Table 4.3.3-4 Flood and Flash Flood Events Reported From 1996 to February 2021 (NOAA NCEI, 2021)			
LOCATION	DATE	TYPE	PROPERTY DAMAGE ($)
Atlasburg, Hendersonville, Lincoln Hill, Studa, Washington	8/10/2018	Flash Flood	$0
Gabby Heights	9/6/2018	Flood	$1,000
Gabby Heights, Independence, Strabane	9/9/2018	Flood	$20,000
Daisytown	9/10/2018	Flood	$15,000
Atlasburg, Hickory	7/7/2019	Flash Flood	$2,000
Burgettstown	10/31/2019	Flood	$0
Bissell	2/13/2020	Flood	$0
East Washington, Linden, Vienna	3/28/2020	Flash Flood	$20,000
Laboratory	3/29/2020	Flash Flood	$10,000
TOTAL			**$14,629,500**

The NFIP identifies properties that experience frequent 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-standards homeowner's and renter's policies. The best way for citizens to protect their property against loss to flood is the 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 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, 2021a). More than 4.9 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 May 2021, Pennsylvania had a total of 50,166 policies in force across the state, 749 of which were in Washington County (FEMA, 2021b).



Washington County's flood zones can be viewed on FEMA's National Flood Hazard Layer: https://www.fema.gov/national-flood-hazard-layer-nfhl

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

Table 4.3.3-5 below lists municipal participation in the NFIP. Of the sixty-six municipalities in Washington County, sixty are actively participating in the NFIP. As of August 2021, two municipalities were suspended: Long Branch Borough and North Bethlehem Township. West Alexander Borough does not participate in the NFIP. The other three municipalities, Claysville Borough, Cokeburg Borough and Green Hills Borough, do not participate in the NFIP.

Table 4.3.3-5 Washington County Municipal Participation in the NFIP (FEMA, 2021c)

COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Allenport Borough	PARTICIPATING	420845	07/16/1981	09/30/2015
Amwell Township	PARTICIPATING	422615	09/15/1989	09/30/2015
Beallsville Borough	PARTICIPATING	422129	09/24/1984	09/30/2015
Bentleyville Borough	PARTICIPATING	420846	06/17/1986	09/30/2015
Blaine Township	PARTICIPATING	422141	07/02/1982	09/30/2015
Buffalo Township	PARTICIPATING	421200	06/11/1982	09/30/2015
Burgettstown Borough	PARTICIPATING	420847	02/17/1989	09/30/2015
California Borough	PARTICIPATING	420848	06/15/1981	09/30/2015
Canonsburg Borough	PARTICIPATING	420849	04/01/1980	09/30/2015
Canton Township	PARTICIPATING	421201	11/05/1986	09/30/2015
Carroll Township	PARTICIPATING	422142	03/18/1980	09/30/2015
Cecil Township	PARTICIPATING	422143	09/05/1979	09/30/2015

Table 4.3.3-5 Washington County Municipal Participation in the NFIP (FEMA, 2021c)

COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Centerville Borough	PARTICIPATING	422552	06/15/1981	09/30/2015
Charleroi Borough	PARTICIPATING	420850	07/16/1981	09/30/2015
Chartiers Township	PARTICIPATING	422144	02/01/1980	09/30/2015
Claysville Borough	NOT PARTICIPATING	422730	09/30/2015	09/30/2015
Coal Center Borough	PARTICIPATING	422131	09/30/1981	09/30/2015
Cokeburg Borough	NOT PARTICIPATING	422731	09/30/2015	09/30/2015
Cross Creek Township	PARTICIPATING	422145	02/01/1987	09/30/2015
Deemston Borough	PARTICIPATING	422132	05/01/1985	09/30/2015
Donegal Township	PARTICIPATING	422146	10/15/1982	09/30/2015
Donora Borough	PARTICIPATING	420851	09/30/1995	09/30/2015
Dunlevy Borough	PARTICIPATING	422133	07/16/1981	09/30/2015
East Bethlehem Township	PARTICIPATING	422140	07/16/1981	09/30/2015
East Finley Township	PARTICIPATING	422147	05/01/1985	09/30/2015
East Washington Borough	PARTICIPATING	422134	09/30/2015	09/30/2015
Elco Borough	PARTICIPATING	420852	07/16/1981	09/30/2015
Ellsworth Borough	PARTICIPATING	422553	09/10/1984	09/30/2015
Fallowfield Township	PARTICIPATING	422148	02/17/1989	09/30/2015
Finleyville Borough	PARTICIPATING	422135	09/01/1986	09/30/2015
Green Hills Borough	NOT PARTICIPATING	422732	09/30/2015	09/30/2015
Hanover Township	PARTICIPATING	422555	09/24/1984	09/30/2015
Hopewell Township	PARTICIPATING	422556	08/06/1982	09/30/2015
Houston Borough	PARTICIPATING	422594	12/18/1979	09/30/2015
Independence Township	PARTICIPATING	421202	02/01/1987	09/30/2015
Jefferson Township	PARTICIPATING	422557	06/30/1976	09/30/2015
Long Branch Borough	SUSPENDED	422136	09/01/1986	09/30/2015
Marianna Borough	PARTICIPATING	420854	06/19/1989	09/30/2015
Midway Borough	PARTICIPATING	422558	08/15/1989	09/30/2015
City of Monongahela	PARTICIPATING	420856	07/03/1986	09/30/2015
Morris Township	PARTICIPATING	422559	08/05/1985	09/30/2015
Mount Pleasant Township	PARTICIPATING	422149	10/08/1982	09/30/2015
New Eagle Borough	PARTICIPATING	420857	03/18/1980	09/30/2015
North Bethlehem Township	SUSPENDED	422560	10/15/1985	09/30/2015
North Charleroi Borough	PARTICIPATING	422137	07/16/1981	09/30/2015
North Franklin Township	PARTICIPATING	422150	07/04/1989	09/30/2015
North Strabane Township	PARTICIPATING	422151	02/15/1980	09/30/2015
Nottingham Township	PARTICIPATING	422561	09/10/1984	09/30/2015
Peters Township	PARTICIPATING	422152	11/01/1979	09/30/2015
Robinson Township	PARTICIPATING	422562	02/25/1983	09/30/2015

Table 4.3.3-5 Washington County Municipal Participation in the NFIP (FEMA, 2021c)				
COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Roscoe Borough	PARTICIPATING	420858	07/16/1981	09/30/2015
Smith Township	PARTICIPATING	422153	07/01/1986	09/30/2015
Somerset Township	PARTICIPATING	422154	07/01/1986	09/30/2015
South Franklin Township	PARTICIPATING	422563	07/17/1989	09/30/2015
South Strabane Township	PARTICIPATING	422155	04/15/1980	09/30/2015
Speers Borough	PARTICIPATING	422138	07/16/1981	09/30/2015
Stockdale Borough	PARTICIPATING	420859	07/16/1981	09/30/2015
Twilight Borough	PARTICIPATING	422564	09/28/1979	09/30/2015
Union Township	PARTICIPATING	420860	02/02/1977	09/30/2015
City of Washington	PARTICIPATING	420861	11/05/1986	09/30/2015
West Alexander Borough	NOT PARTICIPATING	422733	NA	NA
West Bethlehem Township	PARTICIPATING	422156	09/01/1986	09/30/2015
West Brownsville Borough	PARTICIPATING	425391	04/27/1973	09/30/2015
West Finley Township	PARTICIPATING	422565	09/24/1984	09/30/2015
West Middletown Borough	PARTICIPATING	422139	09/30/2015	09/30/2015
West Pike Run Township	PARTICIPATING	422157	09/01/1986	09/30/2015
**Note: McDonald Borough is located in both Allegheny County and Washington County, but is included entirely on the Allegheny FIRM.*				

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 Washington County currently participate in CRS.

Information on NFIP premiums and coverage, prior claims, and substantial damage claims provide additional information on past flood occurrences. Table 4.3.3-6 below shows this information for each community in Washington County.

Table 4.3.3-6 Washington County NFIP Policies and Claims Information (FEMA, 2021b) (FEMA, 2021c)					
COMMUNITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Allenport Borough	35	$2,907,628	27	$120,559	1
Amwell Township	11	$2,240,680	8	$49,187	0
Beallsville Borough	0	$0	0	$0	0
Bentleyville Borough	2	$203,681	2	$38,913	0
Blaine Township	1	$350,000	2	$5,244	0

Table 4.3.3-6 Washington County NFIP Policies and Claims Information (FEMA, 2021b) (FEMA, 2021c)

COMMUNITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
Buffalo Township	3	$439,388	3	$55,946	0
Burgettstown Borough	8	$1,550,229	9	$277,259	0
California Borough	32	$6,775,780	35	$257,039	0
Canonsburg Borough	14	$6,569,761	15	$129,282	2
Canton Township	21	$6,523,401	40	$2,084,957	2
Carroll Township	15	$1,498,694	14	$170,469	0
Cecil Township	27	$5,895,326	40	$736,532	4
Centerville Borough	20	$2,406,631	13	$80,734	2
Charleroi Borough	11	$5,265,550	47	$420,609	1
Chartiers Township	31	$10,614,069	15	$1,411,364	3
Claysville Borough	NA	NA	NA	NA	NA
Coal Center Borough	9	$1,320,367	16	$77,660	1
Cokeburg Borough	NA	NA	NA	NA	NA
Cross Creek Township	7	$828,235	3	$92,326	1
Deemston Borough	1	$140,000	0	$0	0
Donegal Township	0	$0	0	$0	0
Donora Borough	1	$201,095	2	$2,712	0
Dunlevy Borough	4	$631,751	9	$68,075	1
East Bethlehem Township	29	$4,984,606	55	$974,916	10
East Finley Township	4	$697,017	3	$52,153	0
East Washington Borough	2	$245,000	0	$0	0
Elco Borough	13	$1,569,364	33	$245,881	1
Ellsworth Borough	0	$0	0	$0	0
Fallowfield Township	9	$3,941,043	5	$16,945	0
Finleyville Borough	2	$299,216	11	$214,595	1
Green Hills Borough	NA	NA	NA	NA	NA
Hanover Township	4	$384,016	1	$0	0
Hopewell Township	1	$350,000	2	$19,219	0
Houston Borough	34	$4,648,371	50	$779,469	4
Independence Township	4	$833,322	9	$89,708	0
Jefferson Township	0	$0	0	$0	0
Long Branch Borough	0	$0	0	$0	0
Marianna Borough	0	$0	0	$0	0
Midway Borough	9	$1,505,558	7	$24,931	0
City of Monongahela	33	$3,649,114	91	$1,132,601	9
Morris Township	1	$350,000	1	$31,997	0
Mount Pleasant Township	4	$954,166	0	$0	0

Table 4.3.3-6 Washington County NFIP Policies and Claims Information (FEMA, 2021b) (FEMA, 2021c)					
COMMUNITY	POLICIES IN FORCE	TOTAL PREMIUM AND COVERAGE	PRIOR CLAIMS	TOTAL AMOUNT OF PAID CLAIMS	SUBSTANTIAL DAMAGE CLAIMS
New Eagle Borough	1	$123,293	4	$9,934	0
North Bethlehem Township	0	$0	0	$0	0
North Charleroi Borough	8	$471,378	44	$378,634	1
North Franklin Township	13	$3,729,513	13	$97,689	0
North Strabane Township	14	$3,271,549	5	$107,424	0
Nottingham Township	8	$1,423,911	5	$74,852	0
Peters Township	50	$13,304,160	17	$279,921	0
Robinson Township	1	$28,000	1	$2,865	0
Roscoe Borough	64	$5,286,150	52	$330,417	4
Smith Township	12	$1,811,046	2	$10,350	0
Somerset Township	3	$501,843	0	$0	0
South Franklin Township	15	$1,681,464	10	$20,089	0
South Strabane Township	13	$3,799,355	4	$131,621	0
Speers Borough	11	$2,493,931	8	$256,668	0
Stockdale Borough	30	$3,152,528	38	$245,186	5
Twilight Borough	1	$54,000	1	$0	0
Union Township	20	$3,514,828	28	$440,636	1
City of Washington	52	$14,453,253	105	$3,634,533	4
West Alexander Borough	NA	NA	NA	NA	NA
West Bethlehem Township	7	$1,207,981	3	$43,111	0
West Brownsville Borough	19	$1,180,079	29	$207,977	1
West Finley Township	1	$251,981	0	$0	0
West Middletown Borough	0	$0	0	$0	0
West Pike Run Township	4	$463,854	1	$5,507	0
**Note: McDonald Borough is located in both Allegheny County and Washington County, but is included entirely on the Allegheny FIRM. McDonald Borough participated in the 2020 Allegheny County HMP Update.*					

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 4.3.3-7 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 cost for ICC is part of all policies.)

Under FEMA's HMA grant programs, a **Severe Repetitive Loss (SRL)** 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 June 10, 2021, there were 89 RL properties in Washington County, with 12 located in the City of Washington. There are SRL properties in Washington County, three of which are in the City of Washington. Table 4.3.3-7 lists the number of repetitive and severe repetitive loss properties by municipality and tables 4.3.3-8 and 4.3.3-8 list the number of repetitive and severe repetitive loss properties by type.

Table 4.3.3-7 Number of Repetitive and Severe Repetitive Loss Properties by Municipality

MUNICIPALITY	NUMBER OF REPETITIVE LOSS PROPERTIES	NUMBER OF SEVERE REPETITIVE LOSS PROPERTIES
Allenport Borough	2	0
Amwell Township	1	0
California Borough	2	0
Canonsburg Borough	1	0
Canton Township	9	1
Carroll Township	1	0
Cecil Township	3	0
Centerville Borough	1	0
Charleroi Borough	3	0
Chartiers Township	1	0
East Bethlehem Township	4	0
East Finley Township	1	0
Elco Borough	5	0
Fallowfield Township	1	0
Finleyville Borough	1	0
Hopewell Township	1	0
Houston Borough	6	1
Jefferson Township	1	0
McDonald Borough	2	0
Midway Borough	1	0
City of Monongahela	7	1
North Charleroi Borough	6	0
North Franklin Township	1	0
Peters Township	1	0
Roscoe Borough	2	0
Speers Borough	1	0
Stockdale Borough	6	0
Union Township	2	0
City of Washington	12	3
West Bethlehem Township	1	0
West Brownville Borough	2	0
TOTAL	89	6

Table 4.3.3-8 Summary of the Number and Type of Repetitive Loss Properties by Municipality (FEMA, 2021)

MUNICIPALITY	TYPE						SUM OF REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	CONDO	BUSINESS	OTHER RESIDENTIAL	OTHER NON RESIDENTIAL	SINGLE FAMILY	
Allenport Borough	0	0	0	0	0	2	2
Amwell Township	0	0	0	0	0	1	1
California Borough	0	0	0	1	1	0	2
Canonsburg Borough	0	0	0	0	0	1	1

Table 4.3.3-8 Summary of the Number and Type of Repetitive Loss Properties by Municipality (FEMA, 2021)

MUNICIPALITY	TYPE						SUM OF REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	CONDO	BUSINESS	OTHER RESIDENTIAL	OTHER NON RESIDENTIAL	SINGLE FAMILY	
Canton Township	0	1	4	0	2	2	9
Carroll Township	0	0	0	0	1	0	1
Cecil Township	0	0	0	0	0	3	3
Centerville Borough	0	0	0	0	0	1	1
Charleroi Borough	0	0	0	0	3	0	3
Chartiers Township	0	0	1	0	0	0	1
East Bethlehem Township	0	0	0	0	1	3	4
East Finley Township	0	0	0	0	1	0	1
Elco Borough	0	0	0	0	0	5	5
Fallowfield Township	0	0	0	0	0	1	1
Finleyville Borough	0	0	0	0	0	1	1
Hopewell Township	0	0	0	0	0	1	1
Houston Borough	0	0	1	0	0	5	6
Jefferson Township	0	0	1	0	0	0	1
McDonald Borough	0	0	0	0	0	2	2
Midway Borough	0	0	0	0	0	1	1
City of Monongahela	2	0	0	1	3	1	7
North Charleroi Borough	0	1	0	0	1	4	6
North Franklin Township	0	0	0	0	1	0	1
Peters Township	0	0	0	0	0	1	1
Roscoe Borough	0	0	0	0	0	2	2
Speers Borough	0	0	0	0	1	0	1
Stockdale Borough	2	0	0	0	0	4	6
Union Township	0	0	0	0	0	3	3
City of Washington	0	0	7	0	1	4	12
West Bethlehem Township	0	0	0	0	0	1	1
West Brownville Borough	0	0	0	0	1	1	2
TOTAL	4	2	14	2	17	50	89

Table 4.3.3-9 Summary of the Number and Type of Severe Repetitive Loss Properties by Municipality (FEMA, 2021)				
MUNICIPALITY	TYPE			SUM OF SEVERE REPETITIVE LOSS PROPERTIES
	BUSINESS	OTHER NON RESIDENTIAL	SINGLE FAMILY	
Canton Township	0	1	0	1
Houston Borough	0	0	1	1
City of Monongahela	0	1	0	1
City of Washington	3	0	0	3
TOTAL	3	2	1	6

4.3.3.4. Future Occurrence

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. The NFIP recognizes the 1%-annual-chance flood, also known as the base flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. The NFIP uses historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year. A specific flood that is used for a number of purposes is called the base flood, which has a one percent chance of occurring in any particular year. The base flood is often referred to as the "100-year flood" since its probability of occurrence suggests it should reoccur once every 100 years, although this is not the case in practice. Experiencing a 100-year flood does not mean a similar flood cannot happen for the next 99 years; rather it reflects the probability that over a long period of time, a flood of that magnitude has a one percent chance of occurring in any given year. It is therefore referred to in this document as the 1%-chance flood. Table 4.3.3-8 below shows a range of flood recurrence intervals and associated probabilities of occurrence.

Table 4.3.3-10 Recurrence Intervals and Associated Probabilities of Occurrence (USGS, 2021)	
RECURRENCE INTERVAL	CHANCE OF OCCURRENCE IN ANY GIVEN YEAR (%)
10 year	10
50 year	2
100 year	1
500 year	0.2

DFIRMs and FIRMs published by FEMA can be used to identify areas subject to the 1%- and 0.2%-annual-chance flooding. Areas subject to 2%- and 10%-annual-chance events are not shown on maps; however, water surface elevations associated with these events are included in the flood source profiles contained in associated Flood Insurance Study Reports. The most

recent Flood Insurance Study for each County in Pennsylvania is available from the FEMA Map Service Center.

Changing weather patterns have made many types of disasters more frequent and extreme. As frequent and intense rainfalls increase, more severe flooding is being seen in many areas across the State. In general, hazardous precipitation events are increasing in this region. This can also lead to higher instances of flash flooding and river overflow. Climate Central predicts that precipitation rates will more than double in the region surrounding the City of Pittsburgh by 2050, which will have a large impact on localized flooding (Climate Central, 2019).

Despite the fact that 60 of Washington County's 66 municipalities participate in the National Flood Insurance Program (NFIP), communities can take the opportunity to strengthen floodplain management by reviewing current codes and ordinances and by strongly enforcing their floodplain codes on new development to avoid aggravating further flooding. Significant residential growth in the outlying rural townships can increase opportunities for flash flooding if floodplain development and stormwater management are not properly regulated. Numerous times since the January 1996 floods, localized rainstorms went undetected by the National Weather Service and created surface flooding.

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

4.3.3.5. Vulnerability Assessment

Washington County is vulnerable to flooding that causes loss of life, 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.

Flood events frequently cause road closures in the County and its municipalities. Affected areas of roadway may vary from a few feet for only a few hours (as in the case of flash flooding) to several hundred feet for a few days (as in the case of riverine flooding). Road closures limit accessibility to certain areas of the County, which in turn delays the provision of emergency services to the residents in those areas. In addition, despite posted signs warning drivers to stay out of floodwaters, inevitably there are individuals who must be rescued from their cars that become stranded in floodwaters.

Table 4.3.3-9 lists the addressable structures, critical facilities, and populations located in each municipality and in the SFHA. 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 block groups with the SFHA. While this is an estimate, using the block group centroid helps to minimize overestimation of flood-prone populations.

There are 2,789 structures in the SFHA County-wide (2.9% of all structures). Roscoe Borough has the highest proportion of structures in the floodplain at 71.2% of structures vulnerable to flooding. Allenport Borough (41.3%), Coal Center Borough (49.4%), Dunlevy Borough (33.7%), Elco Borough (44.5%), and Stockdale Borogh (49.6%) have the highest percentage of structures located in the floodplain. Eleven municipalities have no structures in the floodplain.

There are 237 critical facilities (15.0%) located in the SFHA. Amwell Township has the highest number of vulnerable critical facilities with 19. There are 22 municipalities that have over 25% of their critical facilities located in the floodplain. Sixteen municipalities have no critical facilities in the SFHA.

About 2.5% of the population lives in the SFHA. Roscoe Borough has the highest number of residents vulnerable to flooding with 600 residents. Six municipalities have over 25% of the population living in the SFHA; Allenport Borough (40.3%), Coal Center Borough (51.1%), Dunlevy Borough (29.0%), Elco Borough (44.8%), Roscoe Borough (73.0%), and Stockdale Borough 48.9%). Eleven municipalities have no population living in the SFHA..

Table 4.3.3-10 lists the number of structures in the SFHA by generalized land use type. Most vulnerable structures (2,126) are residential properties, followed by commercial (498), and industrial (66). Floods also have a significant impact on agricultural crops impacting 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.

Table 4.3.3-11 Community Flood Vulnerability in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
Allenport Borough	259	107	41.3%	8	4	50.0%	556	224	40.3%
Amwell Township	1,683	27	1.6%	61	19	31.1%	3,782	60	1.6%
Beallsville Borough	226	1	0.4%	9	3	33.3%	510	2	0.4%
Bentleyville Borough	1,118	13	1.2%	13	0	0%	2,418	24	1.0%
Blaine Township	278	7	2.5%	10	2	20.0%	690	17	2.5%
Buffalo Township	863	6	0.7%	16	2	12.5%	2,010	14	0.7%
Burgettstown Borough	643	10	1.6%	4	0	0%	1,249	4	0.3%
California Borough	1,875	312	16.6%	27	6	22.2%	6,785	827	12.2%
Canonsburg Borough	4,067	36	0.9%	23	1	4.3%	8,890	19	0.2%
Canton Township	3,874	156	4.0%	44	8	18.2%	8,429	285	3.4%
Carroll Township	2,547	73	2.9%	46	3	6.5%	5,508	147	2.7%
Cecil Township	6,445	34	0.5%	66	7	10.6%	11,270	63	0.6%
Centerville Borough	1,733	149	8.6%	19	6	31.6%	3,312	175	5.3%
Charleroi Borough	2,046	84	4.1%	21	8	38.1%	4,104	103	2.5%
Chartiers Township	4,155	62	1.5%	66	10	15.2%	7,958	101	1.3%
Claysville Borough	330	0	0%	4	0	0%	803	0	0%
Coal Center Borough	83	41	49.4%	1	1	100%	139	71	51.1%
Cokeburg Borough	368	0	0%	4	0	0%	667	0	0%
Cross Creek Township	770	18	2.3%	27	5	18.5%	1,511	19	1.3%
Deemston Borough	365	1	0.3%	14	3	21.4%	665	3	0.5%
Donegal Township	1,246	3	0.2%	36	2	5.6%	2,491	4	0.2%
Donora Borough	2,413	0	0%	24	0	0%	4,907	0	0%
Dunlevy Borough	205	69	33.7%	8	3	37.5%	386	112	29.0%
East Bethlehem Township	1,199	97	8.1%	42	10	23.8%	2,354	158	6.7%

Table 4.3.3-11 Community Flood Vulnerability in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
East Finley Township	623	4	0.6%	17	4	23.5%	1,389	2	0.1%
East Washington Borough	645	0	0%	1	0	0%	1,943	0	0%
Elco Borough	146	65	44.5%	3	2	66.7%	261	117	44.8%
Ellsworth Borough	461	0	0%	7	0	0%	1,027	0	0%
Fallowfield Township	2,116	15	0.7%	65	6	9.2%	4,480	33	0.7%
Finleyville Borough	214	15	7.0%	4	0	0%	420	45	10.7%
Green Hills Borough	6	0	0%	4	0	0%	29	0	0%
Hanover Township	1,253	10	0.8%	30	2	6.7%	2,637	3	0.1%
Hopewell Township	448	6	1.3%	8	3	37.5%	923	1	0.1%
Houston Borough	565	98	17.3%	3	3	100%	1,237	208	16.8%
Independence Township	737	9	1.2%	17	1	5.9%	1,589	12	0.8%
Jefferson Township	543	0	0%	17	0	0%	1,231	13	1.1%
Long Branch Borough	232	0	0%	4	0	0%	482	6	1.2%
Marianna Borough	262	2	0.8%	12	3	25.0%	490	2	0.4%
McDonald Borough	954	0	0%	7	0	0%	1,752	0	0%
Midway Borough	417	32	7.7%	1	0	0%	917	68	7.4%
Monongahela, City of	2,065	184	8.9%	23	13	56.5%	4,297	330	7.7%
Morris Township	467	16	3.4%	13	4	30.8%	1,112	37	3.3%
Mount Pleasant Township	1,705	2	0.1%	51	3	5.9%	3,526	5	0.1%
New Eagle Borough	1,033	6	0.6%	21	2	9.5%	2,189	0	0%
North Bethlehem Township	779	0	0%	22	0	0%	1,594	0	0%

Table 4.3.3-11 Community Flood Vulnerability in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
North Charleroi Borough	578	50	8.7%	4	1	25.0%	1,305	84	6.4%
North Franklin Township	2,023	12	0.6%	42	13	31.0%	4,569	16	0.4%
North Strabane Township	7,373	8	0.1%	76	3	3.9%	13,451	10	0.1%
Nottingham Township	1,329	12	0.9%	16	0	0%	3,030	27	0.9%
Peters Township	9,029	23	0.3%	78	4	5.1%	21,161	33	0.2%
Robinson Township	907	3	0.3%	34	2	5.9%	1,921	0	0%
Roscoe Borough	392	279	71.2%	5	5	100%	822	600	73.0%
Smith Township	2,125	27	1.3%	51	5	9.8%	4,603	53	1.2%
Somerset Township	1,251	2	0.2%	78	9	11.5%	2,748	4	0.1%
South Franklin Township	1,313	24	1.8%	19	2	10.5%	3,297	57	1.7%
South Strabane Township	4,266	11	0.3%	50	3	6.0%	9,337	18	0.2%
Speers Borough	602	39	6.5%	13	6	46.2%	1,154	70	6.1%
Stockdale Borough	250	124	49.6%	5	2	40.0%	493	241	48.9%
Twilight Borough	108	11	10.2%	2	1	50.0%	244	20	8.2%
Union Township	2,861	38	1.3%	52	3	5.8%	5,733	90	1.6%
Washington, City of	5,433	134	2.5%	47	1	2.1%	13,980	250	1.8%
West Bethlehem Township	708	47	6.6%	32	14	43.8%	1,449	86	5.9%
West Brownsville Borough	525	93	17.7%	5	2	40.0%	982	143	14.6%
West Finley Township	435	11	2.5%	24	11	45.8%	878	17	1.9%

Table 4.3.3-11 Community Flood Vulnerability in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES IN SFHA	PERCENT STRUCTURES SFHA	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL ESTIMATED 2010 POPULATION	POPULATION IN SFHA	PERCENT POPULATION IN SFHA
West Middletown Borough	78	0	0%	3	0	0%	139	0	0%
West Pike Run Township	833	71	8.5%	16	1	6.3%	1,558	111	7.1%
TOTAL	96,881	2,789	2.9%	1,575	237	15.0%	207,773	5,244	2.5%

Table 4.3.3-12 Community Flood Vulnerability in Washington County by Structure Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	0	0	0	0	0	107	0	0	107
Amwell Township	3	2	0	0	2	19	1	0	27
Beallsville Borough	0	0	0	0	0	1	0	0	1
Bentleyville Borough	0	4	0	0	0	9	0	0	13
Blaine Township	0	0	0	0	1	6	0	0	7
Buffalo Township	0	0	0	0	1	5	0	0	6
Burgettstown Borough	0	7	0	0	0	3	0	0	10
California Borough	0	100	0	0	13	196	2	1	312
Canonsburg Borough	0	26	1	2	5	2	0	0	36
Canton Township	0	12	0	21	1	122	0	0	156
Carroll Township	0	6	0	0	1	64	2	0	73
Cecil Township	0	2	1	0	1	30	0	0	34
Centerville Borough	0	2	0	2	3	138	3	1	149
Charleroi Borough	0	41	0	1	2	39	0	1	84
Chartiers Township	0	2	0	10	1	49	0	0	62
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	0	0	0	41	0	0	41
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	1	6	0	0	2	9	0	0	18
Deemston Borough	0	0	0	0	0	1	0	0	1
Donegal Township	1	1	0	1	0	0	0	0	3
Donora Borough	0	0	0	0	0	0	0	0	0
Dunlevy Borough	0	4	0	0	0	65	0	0	69
East Bethlehem Township	0	26	1	1	0	68	0	1	97
East Finley Township	1	0	0	0	0	3	0	0	4

Table 4.3.3-12 Community Flood Vulnerability in Washington County by Structure Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
East Washington Borough	0	0	0	0	0	0	0	0	0
Elco Borough	0	0	0	0	1	64	0	0	65
Ellsworth Borough	0	0	0	0	0	0	0	0	0
Fallowfield Township	0	1	0	0	0	14	0	0	15
Finleyville Borough	0	5	0	0	0	10	0	0	15
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	0	0	1	0	0	6	0	0	10
Hopewell Township	0	0	0	0	1	5	0	0	6
Houston Borough	0	34	0	0	1	63	0	0	98
Independence Township	0	2	0	0	0	7	0	0	9
Jefferson Township	0	0	0	0	0	0	0	0	0
Long Branch Borough	0	0	0	0	0	0	0	0	0
Marianna Borough	0	0	0	0	0	1	0	1	2
McDonald Borough	0	0	0	0	0	0	0	0	0
Midway Borough	0	0	0	0	0	32	0	0	32
Monongahela, City of	0	107	1	9	0	66	1	0	184
Morris Township	2	0	0	0	0	14	0	0	16
Mount Pleasant Township	0	0	0	0	0	1	1	0	2
New Eagle Borough	0	0	0	6	0	0	0	0	6
North Bethlehem Township	0	0	0	0	0	0	0	0	0
North Charleroi Borough	0	2	0	1	0	47	0	0	50
North Franklin Township	0	1	0	0	0	10	0	1	12
North Strabane Township	0	0	1	1	1	3	2	0	8
Nottingham Township	0	0	1	0	6	4	1	0	12
Peters Township	1	4	2	0	1	15	0	0	23
Robinson Township	0	0	0	0	2	1	0	0	3

Table 4.3.3-12 Community Flood Vulnerability in Washington County by Structure Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Roscoe Borough	0	4	0	0	0	274	0	1	279
Smith Township	0	2	0	0	0	25	0	0	27
Somerset Township	0	1	0	0	0	1	0	0	2
South Franklin Township	0	0	0	0	1	23	0	0	24
South Strabane Township	0	4	0	1	1	5	0	0	11
Speers Borough	0	27	0	2	0	10	0	0	39
Stockdale Borough	0	0	0	0	1	123	0	0	124
Twilight Borough	0	1	0	0	0	10	0	0	11
Union Township	0	2	0	1	2	33	0	0	38
Washington, City of	0	32	0	7	1	93	1	0	134
West Bethlehem Township	0	8	0	0	1	38	0	0	47
West Brownsville Borough	0	18	0	0	1	74	0	0	93
West Finley Township	0	1	2	0	1	7	0	0	11
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	0	1	0	0	0	70	0	0	71
TOTAL	9	498	11	66	55	2,126	14	7	2,789

Manufactured homes and commercial trailers are also particularly vulnerable to flooding due to their lightweight and unanchored design. The structure database used in this plan update does not include markers for trailer parks or individual trailers. Additional analysis is needed to determine which municipalities have trailer parks located in the SFHA. FEMA recommends anchoring or elevation techniques to protect manufactured homes from flood risk. More information for these techniques can be found online: https://www.fema.gov/manufactured-mobile-home.

Historic resources including landmark buildings, historic structures and sites, commercial and residential districts, rural resources, archaeological and cultural sites, and the historic environment can be impacted by disaster events. Historic and cultural resources can have unique vulnerabilities to hazard events. Depending on the resource, vulnerability to certain hazards may be greater and/or less than that of other assets in the County. Flooding may have a more significant impact on a historic property than other properties, but there may be less of an impact on historic sites such as monuments or cemeteries.

Additional information on flood vulnerability and losses in Washington County, including the 1%-annual-chance flood event results from Hazus, FEMA's loss estimation software, is provided in Section 4.4.3 Potential Loss Estimates.

4.3.4. Landslide

4.3.4.1. 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 occur primarily in colluvial (loose) soil and old landslide debris on steep slopes. Steep mountain slopes across the state have experienced debris avalanches associated with extreme rainfall or rain-on-snow events. Glacial and glacial-like sediments underlie stream bank and lake bluff slumps and other failure areas across much of the northern part of Pennsylvania. 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 a landslide.

Landslides usually occur in areas of Washington 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 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.

According to the Pennsylvania Department of Conservation and Natural Resources (DCNR), southwestern Pennsylvania has by far the highest concentration of landslides, even though much of the state has susceptible areas. Most major and minor highways have sections cut in rock or soil that can fail. Outside the southwest, high susceptibility areas are smaller and have more varied geology and topography. The USGS describes incidence of landslides in Washington County as high. Landslides are a serious risk in the majority of Washington County, and are more likely to occur in the hill and valley areas of the County. Areas of steep slopes associated with the banks of major watercourses in the County could collapse under heavy rainfall to produce a localized landslide. Steep slopes exist along many roads in Washington County especially those that were cut into the hillsides. Figure 4.3.4-1 illustrates Pennsylvania's areas of low, moderate, and high landslide susceptibility.

A slope greater than 7% (approximately around 15 degrees) needs special considerations for building roads according to common engineering practice, and a slope of 15% (approximately around 25 degrees) is generally unstable and highly sensitive to surface changes. Slopes greater than 25% are very unstable. Figure 4.3.4-2 illustrates the location and degree of slopes in Washington County.

The USGS studied landslides in Washington County in the late 1970s, including conducting an extensive survey of landslides. The geological study located many landslides that occurred or were occurring in the County. The mapping program delineated approximately 5,900 slides and identified them as either active, pre-historic, or ancient events. Active landslides are defined as those areas characterized scars that indicate present movement. Pre-Historic landslides are those areas presently stable but characterized by such obvious evidence as hummocky ground and slump blocks that indicate past movement. Ancient Landslides are defined as those areas also presently stable but characterized by very subdued evidence indicating movement occurred in the distant past. Although the latter two types of landslide are defined as presently stable, they can be easily reactivated. In addition, the report found that in Washington County most landslides take place on north-facing slopes with a 20-to-35 percent grade (Pomeroy 1982). The potential of damage to lives or property from this type of natural hazard is significant.

Figure 4.3.4-1 Map of General Landslide Hazard Areas of Pennsylvania and Washington County

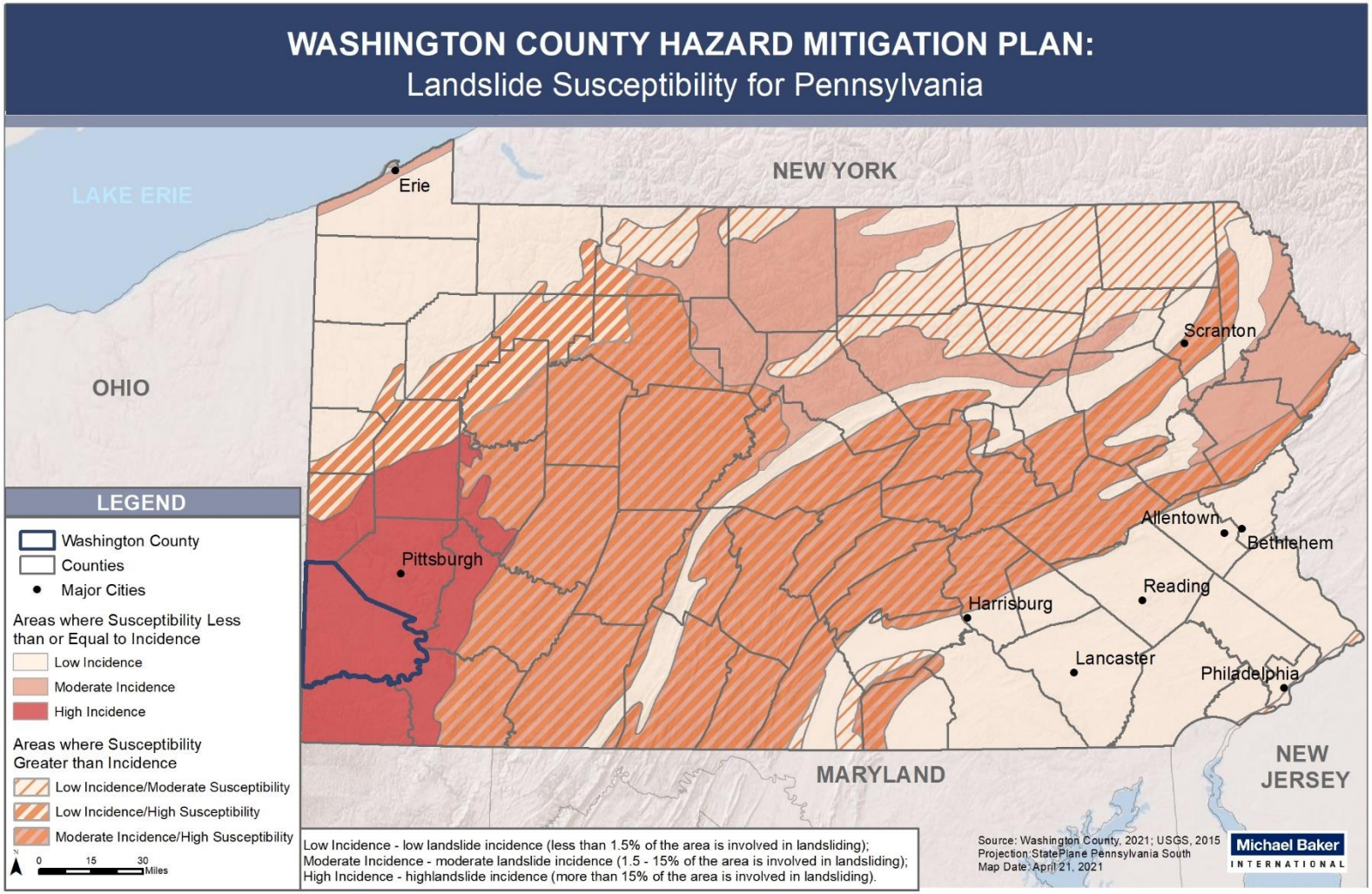
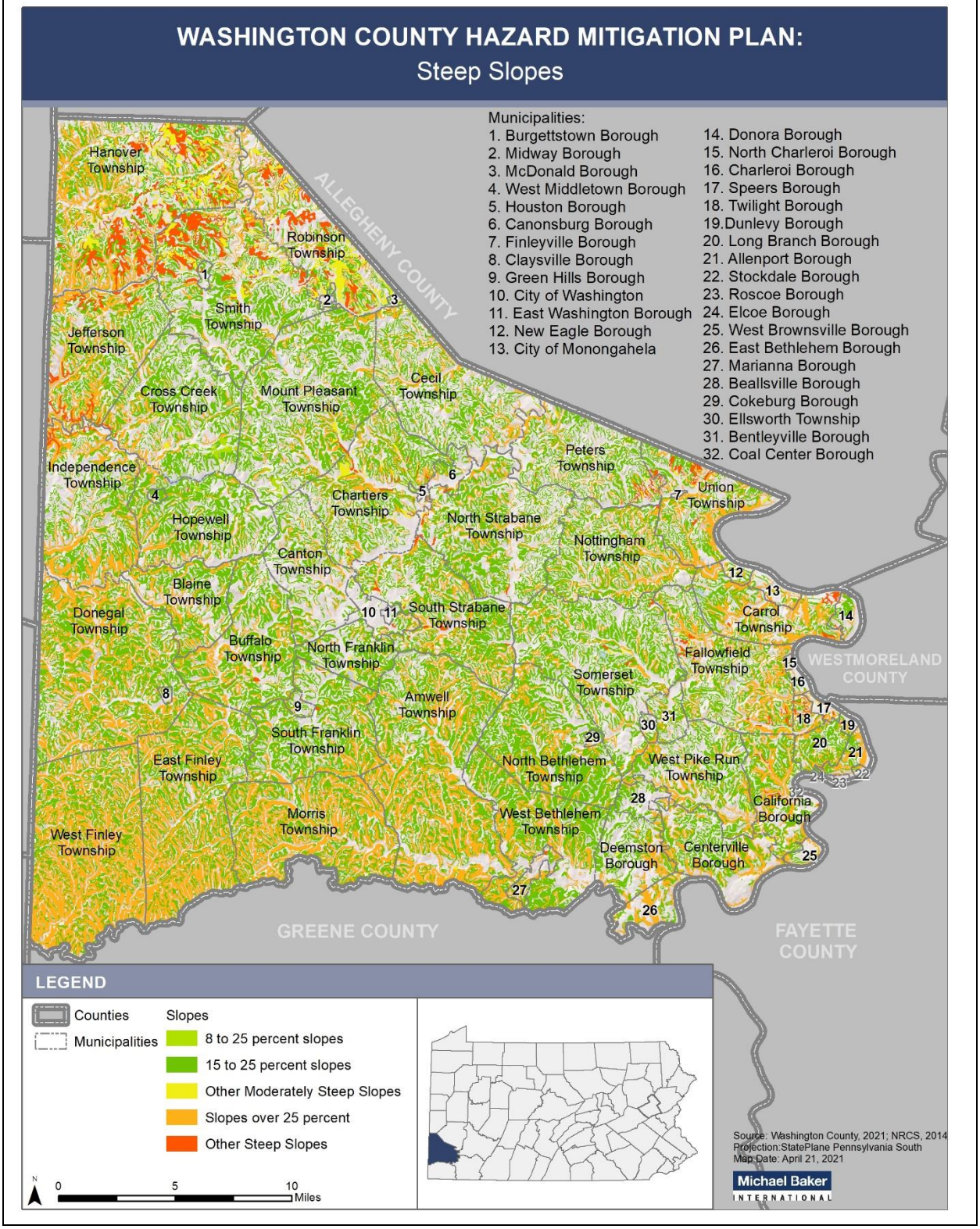


Figure 4.3.4-2 Map of Steep Slope Areas and Municipalities in Washington County



4.3.4.2. 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 of vegetation
- Potential diversion or blockage of water in the vicinity of streams, rivers, etc.
- Increased sediment runoff both during and after event

Beyond the environmental impacts, landslides can have serious impacts on transportation routes, utilities, and buildings depending on their location. Landslides may decrease property values, and the costs of litigation may be significant to local communities.

The Pennsylvania Department of Transportation and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in known landslide-prone areas. A 1991 estimate showed an average of $10 million per year is spent on landslide repair contracts across the Commonwealth and a similar amount is spent on mitigation costs for grading projects (DCNR, 2014).

According to the DCNR website, deaths and injuries due to landslides are rare in Pennsylvania. Almost all of the known deaths due to landslides have occurred when rockfalls or other slides along highways have involved vehicles. Storm induced debris flows are the type of landslide most likely to cause death and injuries. The Pennsylvania Department of Transportation and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in known landslide-prone areas. A 1991 estimate showed an average of $10 million per year is spent on landslide repair contracts across the Commonwealth and a similar amount is spent on mitigation costs for grading projects (PADCNR, 2009).

In Washington County, landslides may occur because of strip mining. 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 property rather than people.

4.3.4.3. Past Occurrence

According to the DCNR, no one really knows how many landslides occur each year in Pennsylvania or how much damage they cause, although there have been a few efforts to determine totals. The USGS landslide inventory aggregates landslide data from various sources to provide a collection of document or likely landslides around the US. NASA's Global Landslide Catalog also lists a partial inventory of landslide, however only three landslides are listed in Washington County in the catalog. The USGS also completed a report on mass movement in southwestern Pennsylvania stating that, "Reconnaissance studies of the

six counties constituting the Greater Pittsburgh area have shown that Washington County is the most susceptible to landslides" (Pomeroy, 1982).

In recent years, there have been several major landslides. In 2018 a catastrophic landslide occurred in the Majestic Hills development in North Strabane (Miller, 2019). The landslide resulted in over $4 million in damage including three homes that were condemned and demolished, and the rerouting of a sewer line in the area. In February 2020, a landslide resulted in the evacuation of 12 homes in South Strabane Township after heavy rain caused a landslide (Sapida, 2020). This incident appears to be related to nearby I-70 road construction.

4.3.4.4. Future Occurrence

Since the exact number of previous landslides over a definite time interval is not known, it is not possible to determine a quantitative probability of future occurrence for landslides in Washington County. Based on historical events, landslide events are highly likely in the County. With many landslide events in the past, the presence of areas susceptible to landslides, and increasing human development near hillsides, landslides causing varying levels of damage are likely to continue to occur every year in the absence of mitigation activities. Mismanaged intense development in steeply sloped areas could increase their frequency of occurrence. Changing weather patterns have resulted in increased precipitation in the region. Climate specialists predict that precipitation intensity will double in and around the City of Pittsburgh by 2050 (Climate Central, 2019). More frequent and intense rainfall is leading to severe flooding and can trigger flash floods and river overflow. Saturated soils create prime conditions for landslides and mudflows. On the whole, the probability of future landslide events can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.4.5. Vulnerability Assessment

A landslide might cause a structure to collapse or might cause minor damages such as broken windows. A landslide might cause a roadway to be temporarily blocked. Transportation routes throughout the County located at the base or crest of cliffs should be considered vulnerable to this hazard. Roadways around Shickshinny Mountain are most vulnerable to landslide events, based on understandings of past events. A comprehensive inventory of these areas is not available.

A landslide vulnerability assessment involves determining the location of susceptible lands and then determining what community assets are located on those susceptible lands. The following steps are typically followed to determine the spatial extent of landslide hazard (FEMA, 2001):

- Identify existing or old landslides:
    - On or at the base of slopes;
    - In or at the base of minor drainage hollows;

    - At the base or top of an old fill slope;
    - At the base or top of a steep cut slope; or
    - Developed hillsides where leach field septic systems are used.
- Map the topography, since steeper slopes have greater probability of landslides.
- Map the geology, because in addition to the slope angle, the presence of rock or soil that weakens when saturated, as well as poorly drained rock or soil are indicators of slope instability as well.
- Contact local and state geological survey, other persons who might be knowledgeable about the local conditions in relation to landslides.

Conditions that may exacerbate or mitigate the severity and effects of landslides include erosion, unstable slopes, earthquakes, increase of weight of slopes, hydrologic factors and human activity. Human activities are responsible for initiating or intensifying certain conditions where otherwise there would have been little or no risk. Activities that increase vulnerability by triggering landslides include:

- Excavations and development in unstable slope materials.
- Haphazard construction or improper use of pipelines.
- Disruption of surface or subsurface drainage (streams and springs) i.e. by filling.
- Overuse of fill materials on slopes, particularly at the heads of existing slide masses.
- Removal of materials at the bases of slopes.
- Vibrations from heavy traffic, blasting, and driving piles near unstable slopes.

Table 4.3.6-1 details the number of structures and critical facilities in each municipality that are in areas with steep slopes and may, therefore, experience damages should a landslide occur. According to PEMA, Washington County is among the most vulnerable Pennsylvania Counties to landslide by numbers of vulnerable people and buildings.

Peters (431) and North Strabane (373) Townships have the largest number of structures in steep slope areas over 25%, while West Finley Township has the greatest percentage of structures in these areas (22%). This vulnerability assessment also measures the number and percentage of critical facilities in steep slope areas across Washington County. Somerset Township (12) has the largest number of critical facilities in steep slope areas over 25%. These municipalities are all more vulnerable to landslide events based on their existing topography and the location of their structures and critical facilities. It is much more likely that a landslide event will occur in a steep slope area over 25%. While all municipalities have some steep slope areas, those with the most structures and critical facilities on this geography are more likely to incur damages from a landslide event.

Table 4.3.4-1 Structures and Critical Facilities Vulnerable to Landslide in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON SLOPES OVER 25%	PERCENT STRUCTURES ON SLOPES OVER 25%	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON SLOPES OVER 25%	PERCENT CRITICAL FACILITIES ON SLOPES OVER 25%
Allenport Borough	259	37	14%	8	0	0%
Amwell Township	1,683	148	9%	61	2	3%
Beallsville Borough	226	1	0%	9	0	0%
Bentleyville Borough	1,118	157	14%	13	3	23%
Blaine Township	278	14	5%	10	1	10%
Buffalo Township	863	45	5%	16	0	0%
Burgettstown Borough	643	2	0%	4	0	0%
California Borough	1,875	107	6%	27	1	4%
Canonsburg Borough	4,067	203	5%	23	1	4%
Canton Township	3,874	154	4%	44	0	0%
Carroll Township	2,547	301	12%	46	3	7%
Cecil Township	6,445	254	4%	66	1	2%
Centerville Borough	1,733	75	4%	19	3	16%
Charleroi Borough	2,046	69	3%	21	0	0%
Chartiers Township	4,155	207	5%	66	7	11%
Claysville Borough	330	0	0%	4	0	0%
Coal Center Borough	83	15	18%	1	0	0%
Cokeburg Borough	368	0	0%	4	0	0%
Cross Creek Township	770	27	4%	27	1	4%
Deemston Borough	365	13	4%	14	1	7%
Donegal Township	1,246	94	8%	36	4	11%
Donora Borough	2,413	182	8%	24	1	4%
Dunlevy Borough	205	22	11%	8	2	25%
East Bethlehem Township	1,199	17	1%	42	7	17%
East Finley Township	623	88	14%	17	1	6%
East Washington Borough	645	0	0%	1	0	0%
Elco Borough	146	8	5%	3	0	0%
Ellsworth Borough	461	9	2%	7	0	0%
Fallowfield Township	2,116	228	11%	65	6	9%
Finleyville Borough	214	0	0%	4	0	0%
Green Hills Borough	6	0	0%	4	0	0%
Hanover Township	1,253	65	5%	30	4	13%
Hopewell Township	448	27	6%	8	0	0%
Houston Borough	565	57	10%	3	0	0%
Independence Township	737	33	4%	17	2	12%

Table 4.3.4-1 Structures and Critical Facilities Vulnerable to Landslide in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON SLOPES OVER 25%	PERCENT STRUCTURES ON SLOPES OVER 25%	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON SLOPES OVER 25%	PERCENT CRITICAL FACILITIES ON SLOPES OVER 25%
Jefferson Township	543	39	7%	17	0	0%
Long Branch Borough	232	28	12%	4	0	0%
Marianna Borough	262	4	2%	12	1	8%
McDonald Borough	954	21	2%	7	0	0%
Midway Borough	417	7	2%	1	0	0%
Monongahela, City of	2,065	116	6%	23	0	0%
Morris Township	467	76	16%	13	3	23%
Mount Pleasant Township	1,705	87	5%	51	2	4%
New Eagle Borough	1,033	99	10%	21	1	5%
North Bethlehem Township	779	24	3%	22	6	27%
North Charleroi Borough	578	26	4%	4	0	0%
North Franklin Township	2,023	87	4%	42	1	2%
North Strabane Township	7,373	373	5%	76	6	8%
Nottingham Township	1,329	103	8%	16	2	13%
Peters Township	9,029	431	5%	78	5	6%
Robinson Township	907	20	2%	34	0	0%
Roscoe Borough	392	0	0%	5	0	0%
Smith Township	2,125	47	2%	51	1	2%
Somerset Township	1,251	39	3%	78	12	15%
South Franklin Township	1,313	54	4%	19	2	11%
South Strabane Township	4,266	225	5%	50	4	8%
Speers Borough	602	34	6%	13	2	15%
Stockdale Borough	250	0	0%	5	0	0%
Twilight Borough	108	19	18%	2	0	0%
Union Township	2,861	279	10%	52	3	6%
Washington, City of	5,433	55	1%	47	1	2%
West Bethlehem Township	708	35	5%	32	7	22%
West Brownsville Borough	525	67	13%	5	1	20%
West Finley Township	435	94	22%	24	4	17%
West Middletown Borough	78	0	0%	3	0	0%
West Pike Run Township	833	57	7%	16	1	6%
GRAND TOTAL	**96,881**	**5,205**	**5%**	**1,575**	**116**	**7%**

Table 4.3.4-2 Structures Vulnerable to Landslide in Washington County by Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	GRAND TOTAL
Allenport Borough	0	0	0	0	0	37	0	0	37
Amwell Township	19	2	5	0	1	118	3	0	148
Beallsville Borough	0	0	0	0	0	1	0	0	1
Bentleyville Borough	0	9	0	0	2	146	0	0	157
Blaine Township	0	0	0	0	0	14	0	0	14
Buffalo Township	3	0	1	0	0	41	0	0	45
Burgettstown Borough	0	0	0	0	0	2	0	0	2
California Borough	0	1	1	0	1	54	50	0	107
Canonsburg Borough	0	6	1	0	0	196	0	0	203
Canton Township	10	1	3	1	0	139	0	0	154
Carroll Township	3	2	4	1	0	257	34	0	301
Cecil Township	4	5	23	4	9	209	0	0	254
Centerville Borough	2	0	2	0	1	59	11	0	75
Charleroi Borough	0	1	0	0	0	68	0	0	69
Chartiers Township	9	1	13	4	1	179	0	0	207
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	3	0	0	12	0	0	15
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	0	0	2	0	0	25	0	0	27
Deemston Borough	0	0	1	0	0	12	0	0	13
Donegal Township	5	0	7	0	0	82	0	0	94
Donora Borough	0	0	0	0	0	182	0	0	182
Dunlevy Borough	0	0	0	0	0	22	0	0	22
East Bethlehem Township	0	1	1	0	1	14	0	0	17
East Finley Township	16	0	3	0	0	63	4	0	88
East Washington Borough	0	0	0	0	0	0	0	0	0
Elco Borough	0	0	1	0	0	7	0	0	8
Ellsworth Borough	0	0	0	0	0	9	0	0	9
Fallowfield Township	1	0	3	0	1	185	38	0	228
Finleyville Borough	0	0	0	0	0	0	0	0	0
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	3	0	2	0	0	60	0	0	65
Hopewell Township	4	0	2	0	0	21	0	0	27
Houston Borough	0	1	0	0	1	55	0	0	57

Table 4.3.4-2 Structures Vulnerable to Landslide in Washington County by Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	GRAND TOTAL
Independence Township	3	0	2	0	0	27	1	0	33
Jefferson Township	4	0	1	0	1	33	0	0	39
Long Branch Borough	0	0	0	0	0	28	0	0	28
Marianna Borough	0	0	0	0	0	4	0	0	4
McDonald Borough	0	1	0	0	0	20	0	0	21
Midway Borough	0	0	0	0	0	7	0	0	7
Monongahela, City of	0	5	0	0	1	110	0	0	116
Morris Township	9	0	8	0	1	54	3	0	76
Mount Pleasant Township	7	0	2	0	1	76	1	0	87
New Eagle Borough	0	1	0	0	0	98	0	0	99
North Bethlehem Township	0	0	2	0	0	22	0	0	24
North Charleroi Borough	0	0	0	0	0	26	0	0	26
North Franklin Township	0	3	2	0	1	81	0	0	87
North Strabane Township	3	18	7	2	26	317	0	0	373
Nottingham Township	2	0	6	0	0	95	0	0	103
Peters Township	7	13	17	0	1	393	0	0	431
Robinson Township	0	0	1	0	0	18	1	0	20
Roscoe Borough	0	0	0	0	0	0	0	0	0
Smith Township	1	1	0	0	0	44	1	0	47
Somerset Township	3	0	1	1	1	33	0	0	39
South Franklin Township	1	0	3	0	1	49	0	0	54
South Strabane Township	2	9	8	0	0	206	0	0	225
Speers Borough	0	1	0	0	0	33	0	0	34
Stockdale Borough	0	0	0	0	0	0	0	0	0
Twilight Borough	0	2	0	0	0	17	0	0	19
Union Township	0	2	5	0	1	238	33	0	279
Washington, City of	0	9	0	0	0	45	1	0	55
West Bethlehem Township	3	1	1	0	0	30	0	0	35
West Brownsville Borough	0	3	0	0	0	64	0	0	67
West Finley Township	15	2	2	0	1	72	2	0	94
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	2	2	2	0	0	51	0	0	57
GRAND TOTAL	141	103	148	13	54	4,560	183	0	5,205

4.3.5. Pandemic and Infectious Disease

4.3.5.1. 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 developed 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.

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 is easily transmittable from person-to-person. Different strands of influenza mutate over time and replace older strands of the virus and thus have drastically different effects. The H1N1 virus, colloquially known as swine flu, is of particular concern. This virus was first detected in people in the United States in April 2009. On June 11, 2009, the world health organization signaled that a pandemic of 2009 H1N1 flu was underway (CDC, 2009). Avian influenza, also known as bird flu, infects birds. A recent strain, H5N1, has caused 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.

In early 2020, 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. Severe reactions that require immediate medical care include trouble breathing, persistent pain or pressure in the chest, new confusion, inability to wake or stay awake, and discolored skin, lips or nail beds (CDC, 2021). In extreme COVID-19 cases that require hospitalization, patients require ventilators to support breathing and may pass away from COVID-19 or COVID-19 related reasons. This virus became a great concern due to its high rates of transmission, in addition to so little being known. The virus has been shown to attack every major organ in the human body. People were advised to shelter in place- only leaving the house for essentials like grocery shopping, and practice social distancing if out but to

avoid gathering in groups. Social disastancing guidance applied outside as well given the ability of the virus to spread through the air.

4.3.5.2. Range of Magnitude

The magnitude of a pandemic or infectious disease threat in Washington 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 4.3.5-1). 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 reduce immune system capacity. These populations are described in more detail in Section 4.3.5.5. Most people infected with swine flu in 2009 recovered without needing medical treatment. Unlike a regular flu season, according to the Centers for Disease Control (CDC) the majority of the people who died, as many as 77%, were 18 to 64 years old with up to 11% 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, 2010). Infection rates were much worse in denser cities, which should be a high priority for response actions in future flu events.

It is believed that COVID-19 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 US. At first, people were mostly concerned with 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.

4.3.5.3. 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 4.3.5-1.

Table 4.3.5-1 List of Previous Significant Outbreaks of Influenza 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 / A/H1N1	12,000

Confirmed flu cases have been relatively stable in Washington County over the past few years. Figure 4.3.7-2 lists the number of confirmed flu cases in Washington County by flu season. According to the Pennsylvania Department of Health (DOH), there were 2,385 confirmed cases in the most recent influenza season from September 2019 to September 2020 (PA DOH, 2020). Complete data for the 2020/2021 flu season was not available at the time this report was written.

The CDC marked the 2014-2015 flu season as severe, with approximately 710,000 hospitalizations. The CDC does not track national deaths in adults, but the organization reported 148 pediatric deaths from influenza. The 2017-2018 flu season was another severe season. The CDC reported that the H3N2 flu, along with other strains including H1N1, led to more cases, doctors' visits, hospital visits, and deaths than previous flu seasons. The CDC also noted that the flu became widespread in all states and jurisdictions at the same time. In January 2018, approximately halfway through the flu season, 37 pediatric deaths were reported. The CDC estimated that 34 million Americans were affected by the flu (CDC, 2018).

Table 4.3.5-2 Confirmed Flu Cases in Washington County by Flu Season (PA DOH, 2020)

FLU SEASON	NUMBER OF CONFIRMED CASES
2014/15	2,021
2015/16	804
2016/17	1,861
2017/18	2,441
2018/19	2,038
2019/20	2,385

An avian flu outbreak in Pennsylvania occurred in 1983-1984, in which 17 million birds were lost. There has not been an outbreak in Pennsylvania since, although there have recently been outbreaks in the Midwest. In 1996-1997, a few 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 Agricutlure 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).

Prior to and during the 2021 Hazard Mitigation Plan Update process, COVID-19 spread worldwide Governor Tom Wolf issued the first stay-at-home order in Pennsylvania on March 23, 2020 for seven counties which was then expanded for all 67 counties on April 1st. Schools were moved to virtual settings, non-essential businesses were closed, and all essential state services were continued operation

As of September 2021, there were more than 1,300,368 confirmed cases and 28,235 deaths in Pennsylvania. In Washington County there were 19,451 confirmed cases and 319 deaths as of September 2021. Neighboring Allegheny County reports over 100,000 confirmed cases with nearly 2,000 deaths (JHU, 2021). These numbers may increase slightly. At least three new variants of the virus have been detected globally, each reaching the United States by January 2021 (CDC, 2021a).

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

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

- Phase 2: Opened on April 13, 2021 – all individuals not previously covered who are 12 and older and do not have a contraindication to the vaccine are eligible (PA DOH, 2021a).

The three vaccines that received emergency approval by the U.S. Food and Drug Administration (FDA) include the Pfizer-BioNTech vaccine, the Johnson & Johnson-Janssen vaccine, and the Moderna vaccine. Each vaccine required a 15-30 minute on-site observation period after receiving the vaccine. The Pfizer-BioNTech and Moderna vaccine requires two shots for immunity; the Johnson & Johnson-Janssen vaccine is a one-shot vaccine. All three vaccines take two weeks after the final shot to be considered fully vaccinated against COVID-19 (CDC, 2021d). As Washington County, and the rest of the nation, continue to get vaccinated during the pandemic, there have been issues with some of those who chose to receive the two-step vaccines with not returning to receive the second dose for full inoculation. In part to widespread misinformation, and a temporary pause in the Johnson & Johnson administration, there are individuals who are choosing not to receive the vaccine. There is a growing concern about a potential additional peak of COVID-19 infections and deaths in this unvaccinated population. As of September 2021, Over 210,000 vaccinations were administered to residents, employees, and visitors in Washington County, with 104,394 people fully vaccinated (PA DOH, 2021).

4.3.5.4. 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, COVID-19 occurred recently. It is impossible to predict a pandemic. 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 *unlikely* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.5.5. Vulnerability Assessment

Certain population groups are at higher risk of pandemic flu infection. This population group includes people 65 years and older, children younger than 5 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, 2015). Children under the age of five and adults over the age of 65 make up approximately 26% of the

Washington County population. Schools, colleges, convalescent centers, and other institutions serving those younger than 5 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. In general, jurisdictions that are more densely populated are more vulnerable to disease threats when the disease is directly spread from human to human, but every jurisdiction in the Commonwealth has some vulnerability to pandemic and infectious disease threats.

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, the Asian and Hong Kong Flu pandemics killed over 1.5 million people worldwide and caused an estimated $32 billion due to lost productivity and medical expenses (Smith, 2004). With Pennsylvania's economy so integral to the national economy, economic losses from a pandemic or infectious disease threat could be significant.

It is expected that there will be immense losses due to the COVID-19 pandemic. Thousands of individuals were laid off across the Commonwealth and non-essential businesses were forced to close. In just one week, over three million Americans filed for unemployment; the greatest number to date. There is specific concern for those who worked in service and hospitality industries. Construction projects and other businesses have resumed slowly, while many others decided to permanently close. The Commonwealth and the federal government released relief packages for individuals and businesses. More information on the COVID-19 Pandemic can be found in Appendix H.

4.3.6. Radon Exposure

4.3.6.1. Location and Extent

Radioactivity caused by airborne radon has been recognized for many years as an important component in the natural background radioactivity exposure of humans, but it was not until the 1980s that the wide geographic distribution of elevated values in houses and the possibility of extremely high radon values in houses were recognized. In 1984, routine monitoring of employees leaving the Limerick nuclear power plant near Reading, PA, 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.

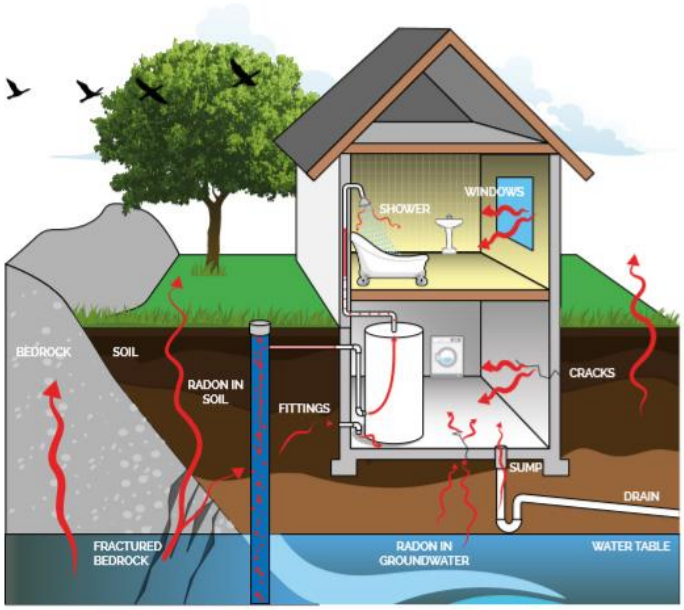
Radon is a gas that cannot be seen or smelled. It is a noble gas that originates by the natural radioactive decay of uranium and thorium. Like other noble gases (i.e., helium, neon, and argon), radon forms essentially no chemical compounds and tends to exist as a gas or as a dissolved atomic constituent 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 form their parent before decay is generally limited to distances of feet or tens of feet.

Three sources of radon are now recognized in houses (shown in Figure 4.3.6-1):

- 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 (i.e. concrete blocks or gypsum wallboard); this is not known to be a problem in Pennsylvania.

Figure 4.3.6-1 Sketch of Radon Entry Points into a House (Specification Online, 2019)



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 win 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 fractures bedrock through the foundation and slab beneath the house, or through cracks in openings for pipes, sumps, and similar features (see Figure 4.3.6-1). 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 on 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. Washington County is classified as having a moderate hazard, meaning that the predicted indoor radon level is greater is between 2 and 4 pCi/L (see Figure 4.3.6-2).

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 parts per million (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.

Figure 4.3.6-2 Radon Hazard Zones in Pennsylvania (EPA, 2021)

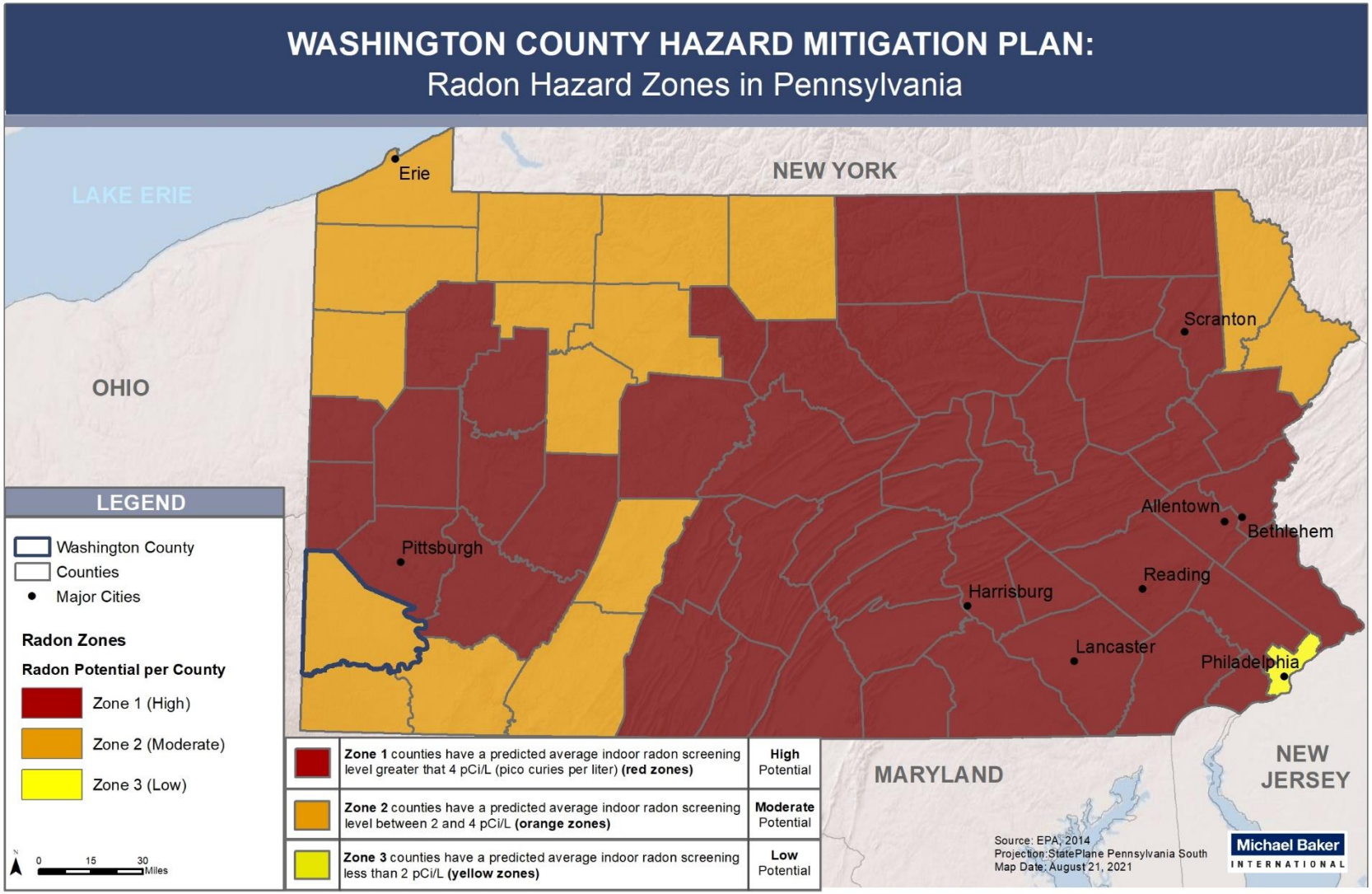


Figure 4.3.6-3 Average Basement Radon Test Results in Washington County

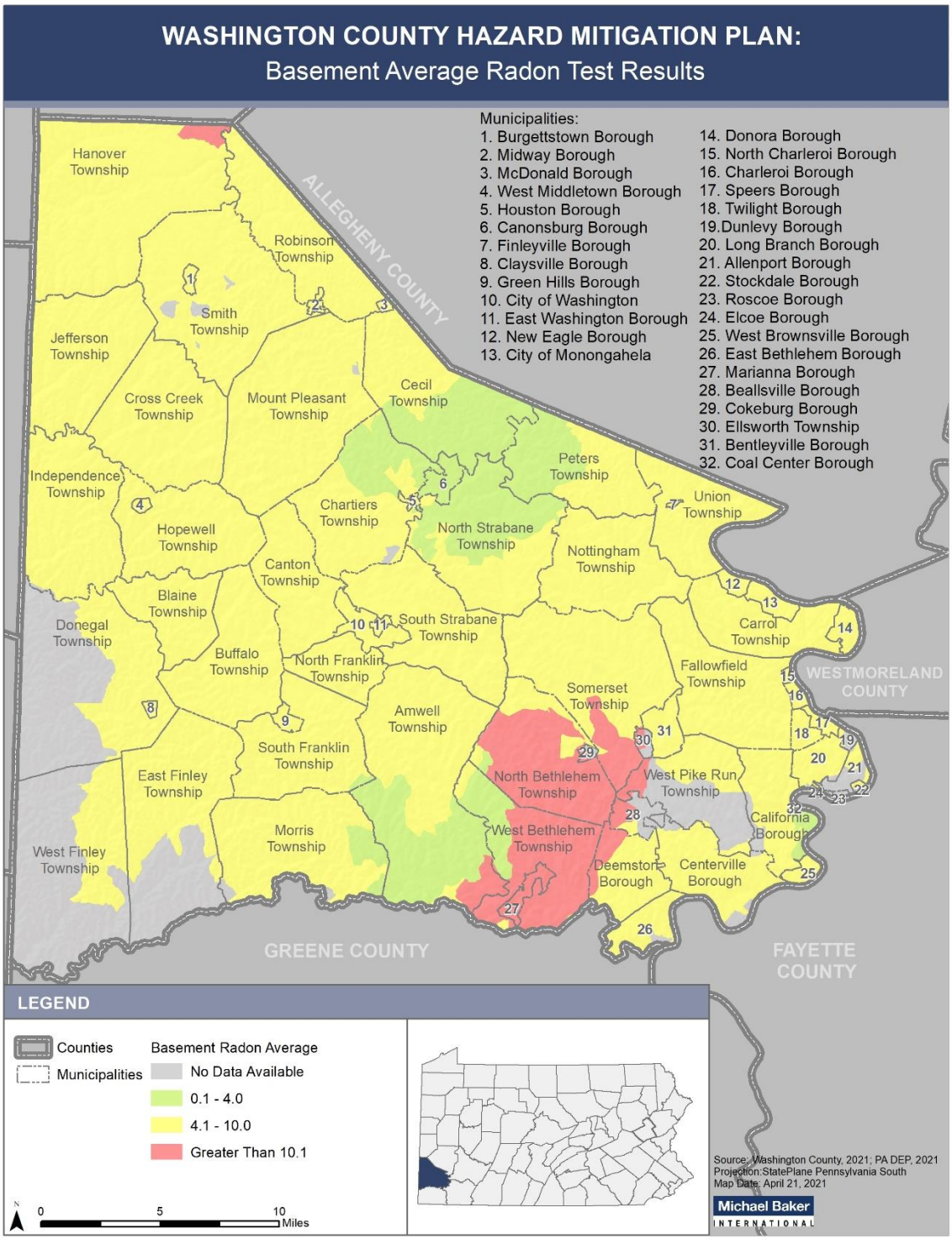
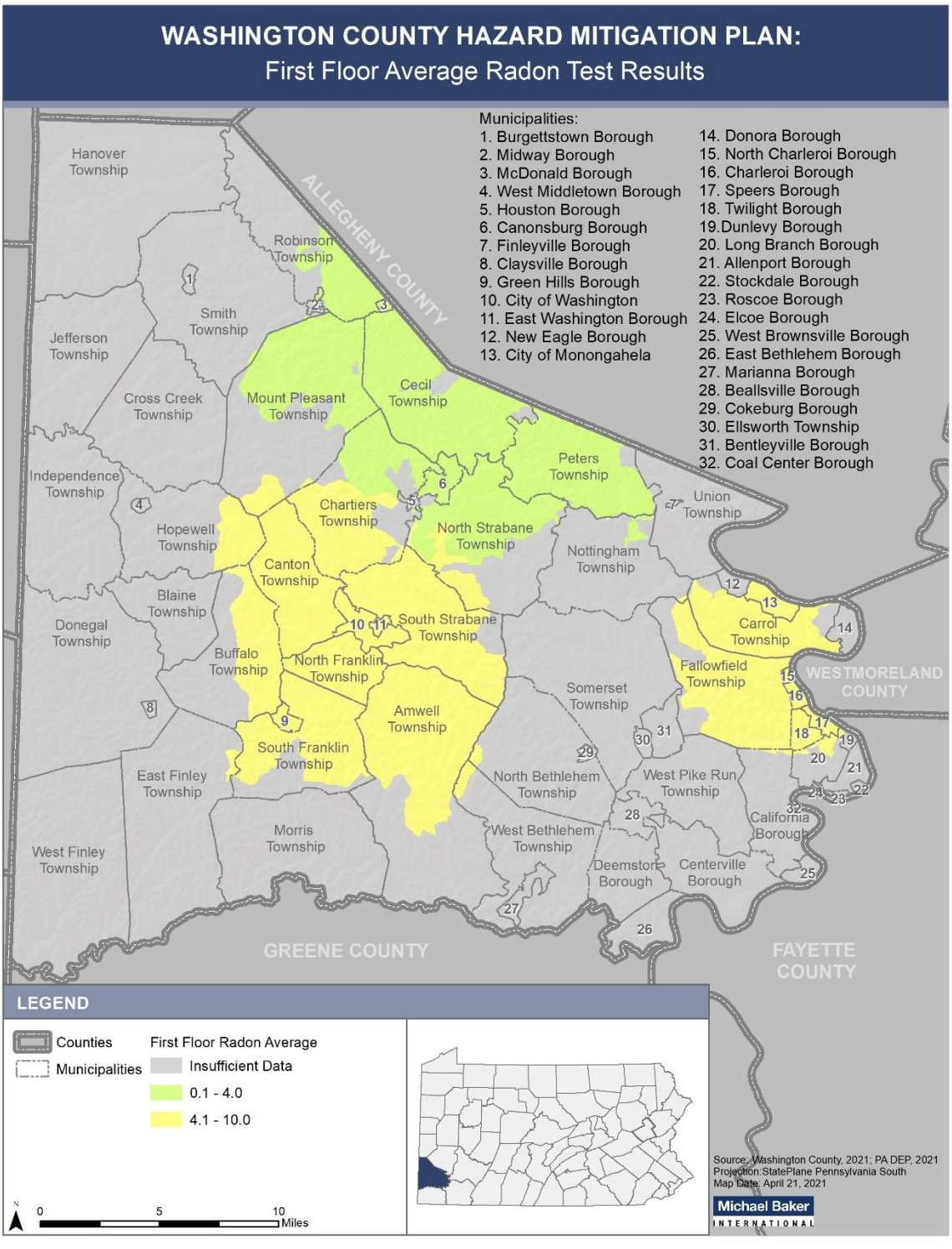


Figure 4.3.6-4 Average First Flood Radon Test Results in Washington County



4.3.6.2. Range of Magnitude

Exposure to radon is the second leading cause of lung cancer after smoking. It is the number one cause of lung cancer among non-smokers. Radon is responsible for about 21,000 lung cancer deaths every year; approximately 2,900 of which occur among people who have never smoked. Lung cancer is the only known effect on human health from exposure to radon in air and thus far, there is no evidence that children are at greater risk of lung cancer than are adults (EPA, March 2010). The main hazard is 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 4.3.6-1 shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As is shown in the table, a smoker exposed to radon has a much higher risk of lung cancer.

Table 4.3.6-1 Radon Risk for Smokers and Non-Smokers (EPA, March 2010)

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 of the risk of dying from food poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	

Table 4.3.6-1 Radon Risk for Smokers and Non-Smokers (EPA, March 2010)			
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
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 without the resident being aware. This worst-case scenario exposure then could lead to large numbers of people with cancer attributed to the radon exposure.

4.3.6.3. 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. Washington County is not an exception. The EPA has estimated that the national average indoor radon concentration is 1.3 pCi/L and the level for action is 4.0 pCi/L; however, they have estimated that the average indoor concentration in Pennsylvania basements is about 7.1 pCi/L and 3.6 pCi/L on the first floor (PA DEP, 2014).

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

In Washington County, 32 ZIP codes have sufficient tests reported to the Bureau to list their findings, which are shown in Table 4.3.6-2. This table does not include the ZIP codes for which insufficient data was collected in both basements and first floors.

Table 4.3.6-2 Average Basement and First Floor Radon Levels in Washington County			
ZIP CODE	NAME	BASEMENT AVERAGE	FIRST FLOOR AVERAGE
15012	Belle Vernon	4.7	3.8
15017	Bridgeville	4	2.2
15019	Bulger	5.8	Insufficient Data
15021	Burgettstown	7.3	Insufficient Data
15022	Charleroi	6.2	4.5
15025	Clairton	4.5	2.9
15026	Clinton	10.9	Insufficient Data
15033	Donora	4.9	Insufficient Data
15043	Georgetown	11.3	Insufficient Data
15050	Hookstown	16.1	Insufficient Data
15055	Lawrence	2.8	Insufficient Data
15057	Mc Donald	5.7	2.9
15060	Midway	4.1	Insufficient Data
15063	Monongahela	4.5	4.6
15067	New Eagle	4.4	Insufficient Data
15126	Imperial	4.6	3.3
15129	South Park	4.2	2.4
15241	Pittsburgh	4.1	2.9
15301	Washington	5.6	4.8
15311	Amity	3.3	Insufficient Data
15312	Avella	4.9	Insufficient Data
15314	Bentleyville	8.6	Insufficient Data
15317	Canonsburg	4	2.9
15321	Cecil	5.2	Insufficient Data
15322	Clarksville	6.3	Insufficient Data
15323	Claysville	7	Insufficient Data
15329	Prosperity	4.9	Insufficient Data
15330	Eighty Four	6.2	Insufficient Data
15332	Finleyville	4.5	Insufficient Data
15333	Fredericktown	7.3	Insufficient Data
15340	Hickory	8.1	Insufficient Data
15342	Houston	4.2	Insufficient Data
15345	Marianna	13	Insufficient Data
15360	Scenery Hill	14	Insufficient Data
15363	Strabane	6.7	Insufficient Data
15367	Venetia	4.5	3.2
15370	Waynesburg	7.8	Insufficient Data
15417	Brownsville	5.2	Insufficient Data
15419	California	3.6	Insufficient Data

Table 4.3.6-2 Average Basement and First Floor Radon Levels in Washington County			
ZIP CODE	NAME	BASEMENT AVERAGE	FIRST FLOOR AVERAGE
15423	Coal Center	4.8	Insufficient Data
15438	Fayette City	4.4	Insufficient Data

4.3.6.4. Future Occurrence

Radon exposure retains a significant probability given present soil, geologic, and geomorphic factors in Washington County. Future occurrence of high radon level hazards can be considered *possible* by the Risk Factor Methodology probability criteria (See Table 4.4.1-1). 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.

4.3.6.5. Vulnerability Assessment

Houses in Washington County, particularly in high vulnerability areas, could be susceptible to moderate levels of radon. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to (see Figure 4.3.6-1). Older houses that have crawl spaces or unfinished basements are more vulnerable as well because of the increased exposure to soils which could be releasing higher levels of radon gas. Additionally, houses that rely on wells for their water may face additional risk, although this type of exposure is low and rare in Pennsylvania.

Proper testing for radon levels should be completed across Washington County, especially in 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.

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

4.3.7. Subsidence, Sinkhole

4.3.7.1. Location and Extent

There are two common causes of subsidence in Pennsylvania: 1) mining activity and 2) dissolution of carbonate rock such as limestone or dolomite. In some parts of Pennsylvania, sinkholes are found in areas underlain by carbonate bedrock. 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-dolomite, which is susceptible to sinkholes, also known as karst topography. Washington County has a history of subsidence due to natural conditions and past mine-related activities.

Natural subsidence results from water movement through naturally occurring fractures and bedding planes that dissolve the bedrock, leaving voids below the surface. Eventually, overburdened, the top of the void collapses, leaving surface depressions resulting in karst topography. Characteristic structures associated with karst topography include sinkholes, linear 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 (i.e. water). Sinkholes are most likely to form following high run-off periods in the spring and fall seasons (DCNR, 2015).

Sinkholes generally develop where the cover above a mine is thin. Sinkhole development normally occurs where the interval to the ground surface is less than three to five times the thickness of the extracted seam and the maximum interval is up to ten times the thickness of the extracted seam (Piggott and Eynon, 1978). In western Pennsylvania, most sinkholes develop where the soil and rock above a mine are less than fifty feet thick (Bruhn et al., 1978).

Other human activities can accelerate the creation of subsidence or sinkhole events. Leaking water pipes or structures that convey storm-water runoff may also result in areas of subsidence as the water dissolves substantial amounts of rock over time. Poorly managed stormwater may be an exacerbating factor in subsidence events. In some cases, construction, land grading, or earthmoving activities that cause changes in stormwater flow can trigger sinkhole events (DCNR, 2015). However, the most substantial human activity within Washington County that puts the County at risk for subsidence and sinkholes is coal mining.

According to the Pennsylvania Department of Environmental Protection (DEP) website, there are two distinct coal fields in Pennsylvania known as the Anthracite and Bituminous coal regions. Bituminous coal is mined in 21 Pennsylvania counties, including Washington County. Washington County faces the problem of mine subsidence in all the areas of the County that have been undermined. These areas are shown in Figure 4.3.7-1.

Areas underlain by coal or other materials which use deep mining techniques may become susceptible to subsidence. Coal mining started in Washington County in the 18th century, before extensive records and environmental assessment was required from the industry. In addition to these numerous abandoned mines from generations past, there are current active mining operations in Washington County today which contribute to coal mining being a top industry. Since the opening of the first recorded coal mine in 1781 to the present, Washington County has produced over a billion tons of coal. It still has an estimated eight billion tons in reserve.

There is a total of 210 coal mining operations within Washington County, down from 253 operations in 2014. Of these 210 mining operations, 124 are active. Most of these operations are both surface and underground mines, and predominately located in Robinson, Smith, and Somerset Townships. See Tables 4.3.7-1 and 4.3.7-2 for the full breakdown of mining operations by municipality, status, and type. Though there are other types of mining operations, only the surface and underground operations are shown as they are the ones most likely to impact subsidence and sinkhole risk. A technical report submitted to the US EPA in 2013 states that approximately 35% of Washington County has been mined using underground mining methods (US EPA, 2013).

Sinkholes of varying sizes have been reported in many areas of Washington County underlain by limestone and subsurface mines. Figure 4.3.7-1 shows that a large portion of Washington County lies in an area of Pennsylvania where limestone/dolomite bedrock is present near ground surface, thus making those areas more susceptible to natural sinkhole development. The map also displays the large areas of Washington County with subsurface coal mines. 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 2021 as changes to geological features occur over a significantly greater timespan.

Figure 4.3.7-1 Areas Subject to Natural and Mine-Related Subsidence in Washington County

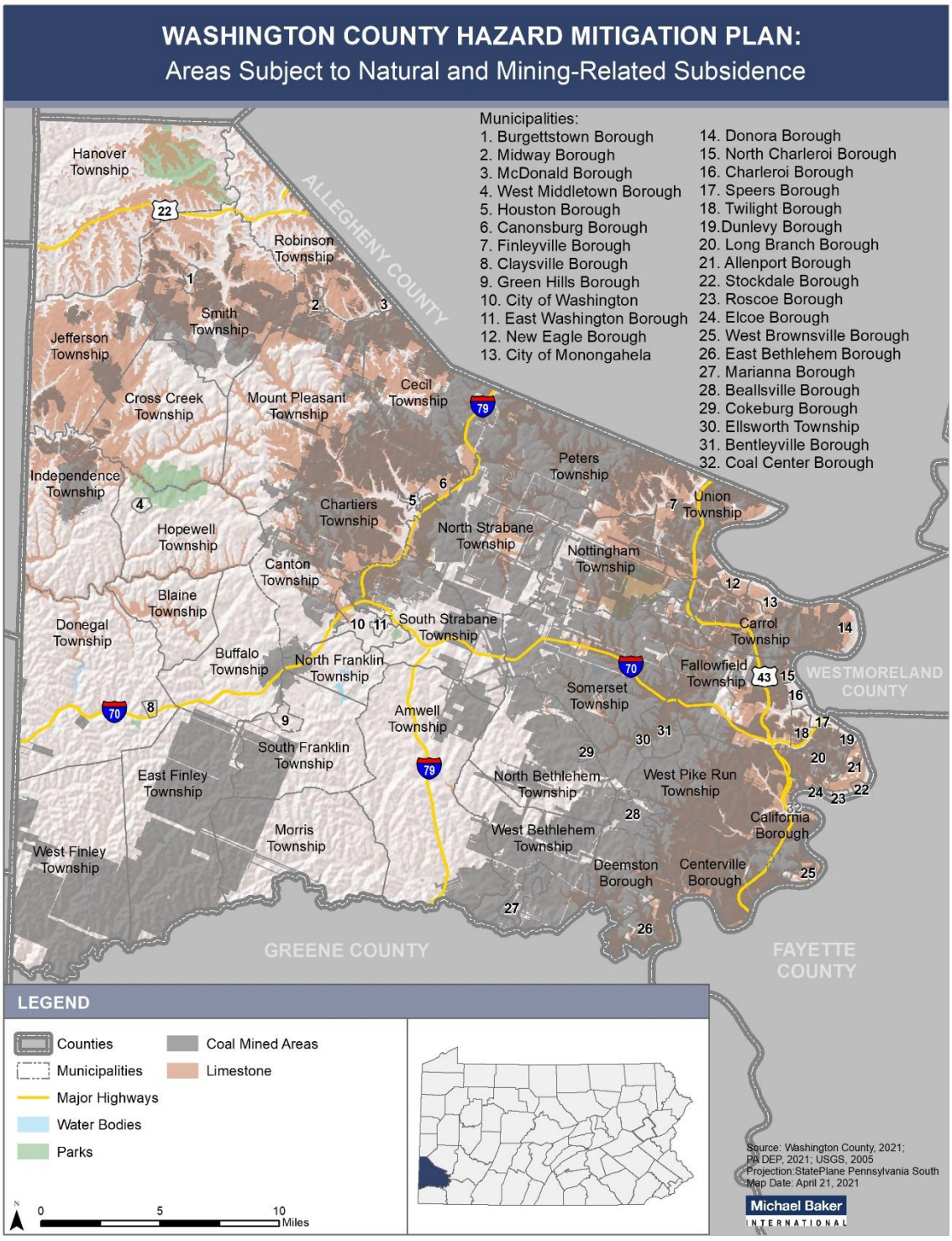


Figure 4.3.7-2 Surface and Underground Mining Locations in Washington County

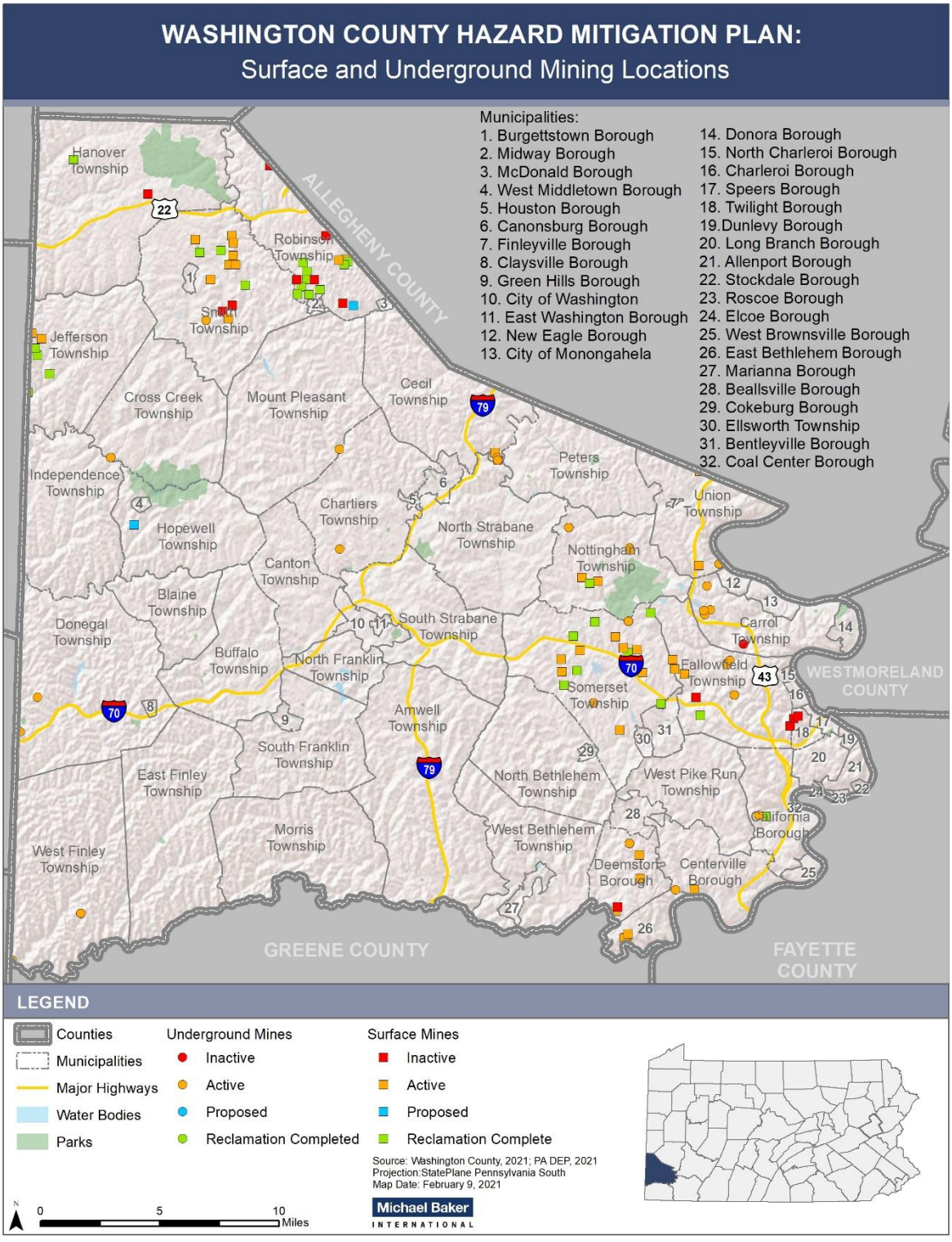


Table 4.3.7-1 Coal Mining Operations in Washington County by Operation Status

MUNICIPALITY	ACTIVE	INACTIVE	PROPOSED BUT NEVER MATERIALIZED	RECLAMATION COMPLETED	TOTAL
California Borough	1	0	0	2	3
Carrol Township	4	2	0	0	6
Cecil Township	3	0	0	0	3
Centerville Borough	3	0	0	0	3
Chartiers Township	1	0	0	0	1
Cross Creek Township	2	0	0	0	2
Deemston Borough	9	2	0	0	11
Donegal Township	2	0	0	0	2
East Bethlehem Township	6	0	0	0	6
Fallowfield Township	13	4	0	5	22
Hanover Township	0	2	0	2	4
Hopewell Township	0	0	2	0	2
Jefferson Township	4	0	0	7	11
Midway Borough	0	0	0	2	2
Mount Pleasant Township	1	0	0	0	1
North Strabane Township	5	0	0	0	5
Nottingham Township	9	0	0	2	11
Robinson Township	5	10	2	15	32
Smith Township	22	4	0	6	32
Somerset Township	23	2	0	12	37
Twilight Borough	0	3	0	0	3
Union Township	8	0	0	0	8
West Finley Township	3	0	0	0	3
TOTAL	124	29	4	53	210

Table 4.3.7-2 Coal Mining Operations in Washington County by Activity

MUNICIPALITY	SURFACE MINE	UNDERGROUND MINE	COAL ABOVE GROUND STORAGE TANK	DISCHARGE POINT	MINERAL PREPARATION PLANT	NPDES DISCHARGE POINT	POST MINING TRMT	TOTAL
California Borough	1	1	0	0	0	1	0	3
Carrol Township	0	1	0	2	0	1	2	6
Cecil Township	1	0	0	1	0	1	0	3
Centerville Borough	1	0	0	1	0	1	0	3
Chartiers Township	0	0	0	0	0	1	0	1
Cross Creek Township	0	1	0	0	0	1	0	2
Deemston Borough	4	1	0	0	1	5	0	11
Donegal Township	0	1	0	0	0	1	0	2
East Bethlehem Township	2	0	0	1	0	2	1	6
Fallowfield Township	7	1	7	0	0	7	0	22
Hanover Township	2	0	0	0	0	2	0	4
Hopewell Township	1	0	0	0	0	1	0	2
Jefferson Township	6	0	0	0	0	5	0	11
Midway Borough	1	0	0	0	0	1	0	2
Mount Pleasant Township	0	1	0	0	0	0	0	1
North Strabane Township	0	0	0	2	0	1	2	5
Nottingham Township	3	2	0	0	1	5	0	11
Robinson Township	16	0	0	1	0	15	0	32
Smith Township	13	1	4	0	0	14	0	32
Somerset Township	15	2	0	0	2	18	0	37
Twilight Borough	2	0	0	0	0	1	0	3
Union Township	2	1	0	0	1	4	0	8
West Finley Township	0	1	0	0	0	2	0	3
TOTAL	77	14	11	8	5	90	5	210

4.3.7.2. Range of Magnitude

No two subsidence areas or sinkholes are exactly alike. Variations in size and shape, time period under which they occur (i.e. gradually or abruptly), and their proximity to development ultimately determines the magnitude of damage incurred. Based on the geologic formations underlying parts of Washington 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. Primarily, problems related to subsidence include the disruption of utility services and damages to private and public property including buildings, roads, and underground infrastructure. 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. If mitigation measures are not taken, the cost to fill in and stabilize sinkholes can be significant although sinkholes are limited in extent.

General recommendations have been published for site investigations prior to construction of buildings due to the potential for karst-related subsidence. These recommendations vary depending on the rock type immediately underlying soil cover. The recommendations include thorough geotechnical investigations to identify un-collapsed karst features and potential excavation to solid rock prior to construction.

With respect to mine subsidence, voids in the earth's subsurface are created where coal was mined. The condition removes a significant portion of the support of the overlying rock strata that usually causes the rock strata to fall or subside into the voids that may damage dwellings or other surface structures above the affected areas. Mining locations across the County should be carefully noted and avoided as sites for new construction, unless the proper measures are taken to ensure the mine's soundness. The degree of surface subsidence or disturbance depends on numerous factors. These include:

1. The vertical distance and the coal;
2. The real extent of mining;
3. The nature of soil and rock strata overlying the mine;
4. The time elapsed since mining was completed; and
5. The loading conditions at the ground surface.

In general, the deeper the mine, the lower the risk of damage due to subsidence. Significant subsidence usually will occur when the depth of the soil and rock strata above the mined out area is less than 100 feet and more than 20 percent of the coal has been removed. Subsidence will occur quite rapidly if all the coal is removed, though subsidence will usually cease within one year after the coal has been removed particularly when modern mining methods are employed. If the mined-out area is supported by pillars of coal, subsidence may not occur for several years or may not occur at all. Longwall mining, where a broad face of

coal is removed at once, has also become prevalent. The associated subsidence is generally not as severe, and more predictable (PA DEP, 2021a).

In terms of environmental impacts, groundwater in limestone and other similar carbonate rock formations can be easily polluted, because water moves readily from the earth's surface down through solution cavities and fractures, thus undergoing very little filtration. Contaminants such as sewage, fertilizers, herbicides, pesticides, or industrial products are also of concern. Over 690 miles of streams and rivers throughout the County have been identified as impaired from pollutants. This represents approximately 35% of the County's total stream length. Most impaired streams are in the northern part of the County where historic surface and subsurface coal mining activities have taken place. The entire length of the Monongahela River along the eastern boundary of the County is also listed as impaired. Chemicals causing surface water impairments in Washington County include chlordane, pesticides, PCBs, metals, pH, siltation, suspended solids, nutrients, and organic enrichment and low dissolved oxygen (US EPA, 2013). Other concerns related to subsidence include the loss of domestic water wells where proximity to a mine causes the well to go dry. Subsidence of mines may also cause dangerous accumulations of natural gas in wells and pump houses that may result in fires and explosions.

The PA DEP prepares five-year reports to document the effects of subsidence resulting from underground bituminous coal mining in Pennsylvania in accordance with Act 54 of the Clean Streams Law. The 2013-2018 report notes that longwall mining activities have moved north toward more suburban areas in Washington County. This has resulted in an increasing number of on-lot wastewater systems that are undermined. Subsidence impacts of wastewater systems are particularly problematic as cracks in the drain field will create flow paths that bypass the soil treatment on which the septic systems rely. Flow paths have the potential to introduce substantial loads of nutrients to local ground and surface waters (PA DEP, 2019).

The magnitude of land subsidence and sinkholes in Washington County can be moderate as there have been past occurrences of land subsidence. Experience in Pennsylvania shows that subsidence may cause from a fraction of an inch to several feet of sagging of the surface of the earth and may occur within minutes or over several years.

According to the PA DEP, structural damages due to subsidence range from slight damage requiring cosmetic repairs to severe damage requiring foundation replacement or other high cost repairs.

The worst subsidence event in Washington County occurred in January 2005 in McDonald Borough and was related to the blowout of an abandoned mine. This resulted in the flooding of several streets and severe damage to several buildings. At one point, the flow rate was estimated at six million gallons per minute. The Bureau of Mines stated this as probably the first in a series of events that will occur regionally (Danehy et al., 2007).

4.3.7.3. Past Occurrence

PA DEP expects that mine-related subsidence is and will continue to be a regular occurrence in Washington County with the extent of mined areas. Isolated incidents throughout the coal regions over the years have occurred when houses, garages, and trees are swallowed up by subsidence holes. Lengths of local streets and highways, and countless building foundations have been damaged. The Pennsylvania Department of Conservation and Natural Resources (DCNR) maintains an online *Sinkhole Inventory Database* of sinkholes throughout the Commonwealth. There have been no naturally-occurring incidents of sinkholes or surface depressions reported to DCNR for Washington County. However, that does not mean they have not occurred.

There is no comprehensive inventory of mine-related subsidence and sinkholes in Pennsylvania. It is known that poor engineering practices at the time of withdrawal or progressive degradation in geological stability contribute to subsidence. Mine subsidence has caused severe structural damage to homes, buildings, roads, and utility lines in Washington County. This type of damage has occurred most frequently over the abandoned underground coal mines located in the eastern part of the County. Lengths of local streets and highways, and countless building foundations have been damaged.

Many records and maps of the old inactive mine workings have been lost, were not accurately recorded, or in many cases, not recorded at all. Consequently, development occurred over unsuspected subsidence prone areas. Pillars of coal, often of only intermediate size and strength support the mine roof. When the supports deteriorate and weaken over an undetermined period, the roof collapses, and subsidence occurs. This non-uniform subsidence causes the most damage on the surface. Pennsylvania's coal regions suffer more subsidence damage from abandoned underground mines than any other state. Damage due to subsidence is not typically covered by homeowner's insurance, so the Commonwealth initiated a mine subsidence insurance program in 1961. This voluntary program covers damage to insured structures caused by vertical or lateral earth movement from mine subsidence. Repair costs on recent subsidence claims have been between $5,000 and $10,000.

In August 2009, a sinkhole roughly 12 feet wide and 20 feet deep opened up along Route 88 in Allenport Borough, temporarily shutting down the road, and restricting its use for several weeks. The sinkhole was believed to be caused by mine subsidence. Several other reports of subsidence and sinkholes in Washington County have occurred in the past ten years. The Department of Environmental Protection's Bureau of Abandoned Mine Reclamation (BAMR) conducted an investigation, and measures were taken to secure the sites (Pittsburgh Post-Gazette, 2009).

In February 2014, mine related subsidence damaged ten homes and displaced multiple families in Charleroi. A portion of Route 481 near the intersection of Coyle Curtain Road buckled and was temporarily patched by Maple Creek Mining Inc., which had begun longwall

mining in the area about a week before the incident occurred. The incident caused the ground the buckle in some spots and in others it heaved upward several feet. This damaged sidewalks, driveways, basements, and utilities. Maple Creek Mining Inc. installed jacks and braces on properties in the area as a precaution before operations began; workers returned to adjust the jacks to try and prevent further damage after the first incident. Some property owners noted their homes moved several feet, had large cracks in the foundation, and walls were bowing inwards several inches. Repairs and relocation expenses were settled between the mining company and property owners (Crompton, 2004).

In July 2015, the Washington County Animal Response Team (CART) rescued an uninjured horse from a natural sinkhole on a farm in Scenery Hill. An underwater stream on the property eroded the land, producing a four-foot-deep sinkhole that the horse fell into (Schaeffer, 2015).The 2013-2018 Act 54 report on subsidence related to mining activities notes that a total of 3,612 structures were undermined across Pennsylvania in the five-year reporting period. Subsidence impacts were reported on 455 structures; mining companies were found liable to these effects on 247 structures (PA DEP, 2019).

There have also been several instances of the covers of sealed abandoned mine shafts collapsing into the shaft, resulting in open shafts, several hundred feet deep.

4.3.7.4. Future Occurrence

Based on geological conditions, subsidence events may occur in the future for the areas of Washington County underlain by carbonate rock such as limestone, but are more likely to occur over mined-out or deep mined areas. Sinkholes and surface depressions are dependent on a few variables, including land use, water management, and coal mining oversight. With the extensive areas underlain by limestone and mine operations, the probability of future subsidence and sinkhole events can be considered *likely* according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.7.5. 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 can cause structural damage and instability in homes, commercial buildings, roads, and bridges. As a natural characteristic of karst watersheds, the presence of high flow-rate springs heightens 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, most municipalities are most vulnerable to sinkhole events. These municipalities have the

highest occurrences of sinkholes. However, any community above karst topography or mined areas is vulnerable to subsidence events.

Most of Washington County's 66 municipalities have identified near-surface limestone and are therefore vulnerable to sinkholes. The only municipalities that do *not* have any near-surface limestone include: West Finley Township, East Finley Township, Morris Township, Green Hills Borough, South Franklin Township, Marianna Borough, Buffalo Township, Claysville Borough, and East Washington Borough.

Table 4.3.7-3 lists structures and critical facilities located over limestone and dolomite bedrock. These are considered the most vulnerable to natural subsidence. The most structures vulnerable to subsidence can be found in Canonsburg Borough (3,639), Cecil Township (3,712), and Peters Township (3,256). Twenty-three municipalities have over half of their structures located over limestone bedrock. Twelve municipalities have no structures located over limestone bedrock.

Table 4.3.7-4 lists structures in each municipality over limestone and dolomite rock by generalized land use type. Most structures over limestone in the County (87.9%) are residential structures (9,876). Commercial and agriculture structures are the next most vulnerable land use categories to subsidence incidents, with 1,920 and 856 vulnerable structures in each category.

Table 4.3.7-3 Structures and Critical Facilities Vulnerable to Subsidence in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES OVER LIMESTONE	PERCENT STRUCTURES OVER LIMESTONE	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES OVER LIMESTONE	PERCENT CRITICAL FACILITIES OVER LIMESTONE
Allenport Borough	259	40	15.4%	8	0	0%
Amwell Township	1,683	18	1.1%	61	2	3.3%
Beallsville Borough	226	0	0.0%	9	0	0%
Bentleyville Borough	1,118	839	75.0%	13	7	53.8%
Blaine Township	278	17	6.1%	10	2	20.0%
Buffalo Township	863	1	0.1%	16	0	0%
Burgettstown Borough	643	310	48.2%	4	1	25.0%
California Borough	1,875	1,564	83.4%	27	16	59.3%
Canonsburg Borough	4,067	3,639	89.5%	23	21	91.3%
Canton Township	3,874	961	24.8%	44	12	27.3%
Carroll Township	2,547	1,310	51.4%	46	20	43.5%
Cecil Township	6,445	3,712	57.6%	66	48	72.7%
Centerville Borough	1,733	1,152	66.5%	19	11	57.9%
Charleroi Borough	2,046	144	7.0%	21	1	4.8%
Chartiers Township	4,155	2,980	71.7%	66	38	57.6%
Claysville Borough	330	0	0%	4	0	0%
Coal Center Borough	83	35	42.2%	1	0	0%
Cokeburg Borough	368	0	0%	4	0	0%
Cross Creek Township	770	335	43.5%	27	17	63.0%
Deemston Borough	365	78	21.4%	14	5	35.7%
Donegal Township	1,246	18	1.4%	36	1	2.8%
Donora Borough	2,413	1,395	57.8%	24	7	29.2%
Dunlevy Borough	205	59	28.8%	8	3	37.5%
East Bethlehem Township	1,199	1,042	86.9%	42	27	64.3%
East Finley Township	623	0	0%	17	0	0%

Table 4.3.7-3 Structures and Critical Facilities Vulnerable to Subsidence in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES OVER LIMESTONE	PERCENT STRUCTURES OVER LIMESTONE	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES OVER LIMESTONE	PERCENT CRITICAL FACILITIES OVER LIMESTONE
East Washington Borough	645	0	0%	1	0	0%
Elco Borough	146	30	20.5%	3	1	33.3%
Ellsworth Borough	461	174	37.7%	7	3	42.9%
Fallowfield Township	2,116	1,332	62.9%	65	48	73.8%
Finleyville Borough	214	200	93.5%	4	4	100%
Green Hills Borough	6	0	0.0%	4	0	0%
Hanover Township	1,253	368	29.4%	30	16	53.3%
Hopewell Township	448	54	12.1%	8	2	25.0%
Houston Borough	565	19	3.4%	3	0	0%
Independence Township	737	263	35.7%	17	9	52.9%
Jefferson Township	543	391	72.0%	17	13	76.5%
Long Branch Borough	232	175	75.4%	4	3	75.0%
Marianna Borough	262	0	0%	12	0	0%
McDonald Borough	954	399	41.8%	7	0	0%
Midway Borough	417	323	77.5%	1	1	100%
Monongahela, City of	2,065	1,284	62.2%	23	5	21.7%
Morris Township	467	0	0%	13	0	0%
Mount Pleasant Township	1,705	856	50.2%	51	28	54.9%
New Eagle Borough	1,033	768	74.3%	21	13	61.9%
North Bethlehem Township	779	1	0.1%	22	0	0%
North Charleroi Borough	578	368	63.7%	4	1	25.0%
North Franklin Township	2,023	0	0%	42	0	0%
North Strabane Township	7,373	1,843	25.0%	76	33	43.4%
Nottingham Township	1,329	445	33.5%	16	7	43.8%
Peters Township	9,029	3,256	36.1%	78	56	71.8%
Robinson Township	907	417	46.0%	34	16	47.1%
Roscoe Borough	392	0	0%	5	0	0%

Table 4.3.7-3 Structures and Critical Facilities Vulnerable to Subsidence in Washington County

MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES OVER LIMESTONE	PERCENT STRUCTURES OVER LIMESTONE	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES OVER LIMESTONE	PERCENT CRITICAL FACILITIES OVER LIMESTONE
Smith Township	2,125	1,408	66.3%	51	38	74.5%
Somerset Township	1,251	292	23.3%	78	26	33.3%
South Franklin Township	1,313	0	0%	19	0	0%
South Strabane Township	4,266	711	16.7%	50	12	24.0%
Speers Borough	602	201	33.4%	13	2	15.4%
Stockdale Borough	250	6	2.4%	5	0	0%
Twilight Borough	108	61	56.5%	2	1	50.0%
Union Township	2,861	2,076	72.6%	52	31	59.6%
Washington, City of	5,433	783	14.4%	47	7	14.9%
West Bethlehem Township	708	48	6.8%	32	2	6.3%
West Brownsville Borough	525	482	91.8%	5	4	80.0%
West Finley Township	435	3	0.7%	24	1	4.2%
West Middletown Borough	78	0	0%	3	0	0%
West Pike Run Township	833	539	64.7%	16	7	43.8%
TOTAL	96,881	39,225	40.5%	1,575	629	39.9%

Table 4.3.7-4 Structures Over Limestone in Washington County by Generalized Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	1	0	1	0	3	35	0	0	40
Amwell Township	0	0	0	0	0	18	0	0	18
Beallsville Borough	0	0	0	0	0	0	0	0	0
Bentleyville Borough	0	135	0	0	3	701	0	0	839
Blaine Township	2	0	2	0	1	12	0	0	17
Buffalo Township	1	0	0	0	0	0	0	0	1
Burgettstown Borough	0	11	0	0	0	299	0	0	310
California Borough	11	185	1	0	53	1,220	94	0	1,564
Canonsburg Borough	0	274	8	28	13	3,316	0	0	3,639
Canton Township	42	48	2	39	10	820	0	0	961
Carroll Township	11	10	9	3	6	1,215	56	0	1,310
Cecil Township	138	127	70	47	91	3,233	5	0	3,712
Centerville Borough	25	26	7	2	9	1,028	54	1	1,152
Charleroi Borough	0	1	0	0	0	142	1	0	144
Chartiers Township	233	43	191	38	14	2,447	13	1	2,980
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	3	0	0	32	0	0	35
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	27	5	7	0	7	288	1	0	335
Deemston Borough	2	0	3	0	1	72	0	0	78
Donegal Township	2	0	1	0	0	15	0	0	18
Donora Borough	0	0	3	0	5	1,385	2	0	1,395
Dunlevy Borough	0	0	1	0	0	58	0	0	59
East Bethlehem Township	1	6	5	1	16	1,011	0	0	1,042
East Finley Township	0	0	0	0	0	0	0	0	0
East Washington Borough	0	0	0	0	0	0	0	0	0
Elco Borough	0	0	1	0	0	29	0	0	30
Ellsworth Borough	0	8	0	0	0	166	0	0	174

Table 4.3.7-4 Structures Over Limestone in Washington County by Generalized Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Fallowfield Township	19	19	9	3	7	1,198	77	0	1,332
Finleyville Borough	0	76	0	0	0	124	0	0	200
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	3	43	9	0	24	284	4	0	368
Hopewell Township	1	0	4	0	0	49	0	0	54
Houston Borough	0	0	0	0	1	18	0	0	19
Independence Township	10	1	4	0	1	243	4	0	263
Jefferson Township	38	3	6	0	5	335	4	0	391
Long Branch Borough	4	0	0	0	2	168	1	0	175
Marianna Borough	0	0	0	0	0	0	0	0	0
McDonald Borough	0	3	0	0	0	297	0	0	399
Midway Borough	0	4	0	0	1	318	0	0	323
Monongahela, City of	0	2	1	0	7	1,274	0	0	1,284
Morris Township	0	0	0	0	0	0	0	0	0
Mount Pleasant Township	87	13	7	0	5	740	4	0	856
New Eagle Borough	0	7	0	1	2	758	0	0	768
North Bethlehem Township	0	0	0	0	0	1	0	0	1
North Charleroi Borough	0	0	0	0	0	368	0	0	368
North Franklin Township	0	0	0	0	0	0	0	0	0
North Strabane Township	44	141	53	11	45	1,546	3	0	1,843
Nottingham Township	19	2	17	0	13	392	2	0	445
Peters Township	37	408	24	0	23	2,760	2	1	3,256
Robinson Township	4	2	2	1	10	381	9	0	417
Roscoe Borough	0	0	0	0	0	0	0	0	0
Smith Township	26	61	11	6	14	1,283	7	0	1,408
Somerset Township	19	18	2	0	2	250	1	0	292
South Franklin Township	0	0	0	0	0	0	0	0	0
South Strabane Township	4	62	41	9	35	560	0	0	711

Table 4.3.7-4 Structures Over Limestone in Washington County by Generalized Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Speers Borough	0	1	0	0	0	200	0	0	201
Stockdale Borough	0	0	0	0	0	6	0	0	6
Twilight Borough	1	0	0	0	2	58	0	0	61
Union Township	14	20	17	0	29	1,939	56	0	2,076
Washington, City of	0	116	0	13	0	654	0	0	783
West Bethlehem Township	1	0	0	0	0	47	0	0	48
West Brownsville Borough	0	20	2	0	3	456	1	0	482
West Finley Township	0	2	0	0	0	1	0	0	3
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	29	17	6	0	2	481	4	0	539
TOTAL	856	1,920	530	202	465	9,876	405	3	11,232

Fifty-seven of the 66 municipalities in Washington County have structures located in areas that have been mined, and nearly half of all structures and half of all critical facilities in the County are underlain by coal mining operations. Twenty-three municipalities have over 50% of structures on underground mine areas and twenty-two municipalities have over 50% of critical facilities on underground mine areas. This is particularly prevalent in the eastern side of the County. The majority of structures on underground mine areas are residential properties, representing 88.2% of structures vulnerable to mine related subsidence. The next highest land use categories are agriculture, commercial, and forest. Tables 4.3.7-5 and 4.3.7-6 inventory structures and critical facilities vulnerable to mine-related subsidence.

Table 4.3.7-5 Structures and Critical Facilities Vulnerable to Mining Subsidence in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON UNDERGROUND MINE AREAS	PERCENT STRUCTURES ON UNDERGROUND MINE AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON UNDERGROUND MINE AREAS	PERCENT CRITICAL FACILITIES ON UNDERGROUND MINE AREAS
Allenport Borough	259	6	2.3%	8	0	0%
Amwell Township	1,683	205	12.2%	61	11	18.0%
Beallsville Borough	226	220	97.3%	9	8	88.9%
Bentleyville Borough	1,118	1,118	100%	13	13	100%
Blaine Township	278	0	0%	10	0	0%
Buffalo Township	863	119	13.8%	16	0	0%
Burgettstown Borough	643	6	0.9%	4	1	25.0%
California Borough	1,875	1,158	61.8%	27	15	55.6%
Canonsburg Borough	4,067	2,354	57.9%	23	3	13.0%
Canton Township	3,874	1,320	34.1%	44	21	47.7%
Carroll Township	2,547	2,103	82.6%	46	35	76.1%
Cecil Township	6,445	4,996	77.5%	66	50	75.8%
Centerville Borough	1,733	1,613	93.1%	19	11	57.9%
Charleroi Borough	2,046	16	0.8%	21	0	0%
Chartiers Township	4,155	1,962	47.2%	66	26	39.4%
Claysville Borough	330	0	0%	4	0	0%
Coal Center Borough	83	2	2.4%	1	0	0%
Cokeburg Borough	368	368	100%	4	4	100%
Cross Creek Township	770	54	7.0%	27	1	3.7%
Deemston Borough	365	339	92.9%	14	14	100%
Donegal Township	1,246	26	2.1%	36	0	0%
Donora Borough	2,413	324	13.4%	24	6	25.0%
Dunlevy Borough	205	27	13.2%	8	0	0%
East Bethlehem Township	1,199	885	73.8%	42	22	52.4%
East Finley Township	623	497	79.8%	17	16	94.1%

Table 4.3.7-5 Structures and Critical Facilities Vulnerable to Mining Subsidence in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON UNDERGROUND MINE AREAS	PERCENT STRUCTURES ON UNDERGROUND MINE AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON UNDERGROUND MINE AREAS	PERCENT CRITICAL FACILITIES ON UNDERGROUND MINE AREAS
East Washington Borough	645	0	0%	1	0	0%
Elco Borough	146	0	0%	3	0	0%
Ellsworth Borough	461	461	100%	7	7	100%
Fallowfield Township	2,116	1,449	68.5%	65	34	52.3%
Finleyville Borough	214	0	0%	4	0	0%
Green Hills Borough	6	0	0%	4	0	0%
Hanover Township	1,253	1	0.1%	30	0	0%
Hopewell Township	448	10	2.2%	8	0	0%
Houston Borough	565	3	0.5%	3	0	0%
Independence Township	737	257	34.9%	17	8	47.1%
Jefferson Township	543	99	18.2%	17	0	0%
Long Branch Borough	232	216	93.1%	4	4	100%
Marianna Borough	262	261	99.6%	12	11	91.7%
McDonald Borough	954	102	10.7%	7	0	0%
Midway Borough	417	32	7.7%	1	0	0%
Monongahela, City of	2,065	262	12.7%	23	1	4.3%
Morris Township	467	87	18.6%	13	2	15.4%
Mount Pleasant Township	1,705	340	19.9%	51	9	17.6%
New Eagle Borough	1,033	78	7.6%	21	0	0%
North Bethlehem Township	779	455	58.4%	22	10	45.5%
North Charleroi Borough	578	113	19.6%	4	0	0%
North Franklin Township	2,023	219	10.8%	42	2	4.8%
North Strabane Township	7,373	5,812	78.8%	76	48	63.2%
Nottingham Township	1,329	910	68.5%	16	10	62.5%
Peters Township	9,029	8,197	90.8%	78	69	88.5%

Table 4.3.7-5 Structures and Critical Facilities Vulnerable to Mining Subsidence in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	TOTAL STRUCTURES ON UNDERGROUND MINE AREAS	PERCENT STRUCTURES ON UNDERGROUND MINE AREAS	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES ON UNDERGROUND MINE AREAS	PERCENT CRITICAL FACILITIES ON UNDERGROUND MINE AREAS
Robinson Township	907	225	24.8%	34	1	2.9%
Roscoe Borough	392	0	0%	5	0	0%
Smith Township	2,125	1,045	49.2%	51	23	45.1%
Somerset Township	1,251	1,067	85.3%	78	51	65.4%
South Franklin Township	1,313	249	19.0%	19	4	21.1%
South Strabane Township	4,266	2,166	50.8%	50	27	54.0%
Speers Borough	602	292	48.5%	13	1	7.7%
Stockdale Borough	250	0	0%	5	0	0%
Twilight Borough	108	26	24.1%	2	0	0%
Union Township	2,861	1,369	47.9%	52	25	48.1%
Washington, City of	5,433	221	4.1%	47	0	0%
West Bethlehem Township	708	535	75.6%	32	30	93.8%
West Brownsville Borough	525	234	44.6%	5	0	0%
West Finley Township	435	200	46.0%	24	14	58.3%
West Middletown Borough	78	0	0%	3	0	0%
West Pike Run Township	833	727	87.3%	16	15	93.8%
TOTAL	96,881	47,438	49.0%	1,575	663	42.1%

Table 4.3.7-6 Structures Over Mined Areas in Washington County by Generalized Land Use Type										
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UNKNOWN	UTILITIES	WATER	TOTAL
Allenport Borough	0	0	0	0	0	6	0	0	0	6
Amwell Township	33	5	3	0	3	159	0	2	0	205
Beallsville Borough	7	14	0	0	2	197	0	0	0	220
Bentleyville Borough	8	135	1	0	9	964	0	1	0	1,118
Blaine Township	0	0	0	0	0	0	0	0	0	0
Buffalo Township	2	0	0	0	0	116	0	1	0	119
Burgettstown Borough	0	0	0	0	0	6	0	0	0	6
California Borough	12	20	5	0	23	1,015	0	83	0	1,158
Canonsburg Borough	0	26	12	6	4	2,306	0	0	0	2,354
Canton Township	36	46	8	5	12	1,207	0	6	0	1,320
Carroll Township	15	24	9	0	18	1,942	0	95	0	2,103
Cecil Township	388	70	213	56	250	4,003	3	12	1	4,996
Centerville Borough	24	32	8	0	11	1,474	0	64	0	1,613
Charleroi Borough	0	0	0	0	0	16	0	0	0	16
Chartiers Township	165	30	174	12	13	1,548	0	18	2	1,962
Claysville Borough	0	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	0	0	0	2	0	0	0	2
Cokeburg Borough	0	2	6	0	2	358	0	0	0	368
Cross Creek Township	3	0	4	0	0	46	0	1	0	54
Deemston Borough	26	0	12	0	4	293	0	4	0	339
Donegal Township	8	2	0	0	0	16	0	0	0	26
Donora Borough	0	0	0	0	4	320	0	0	0	324
Dunlevy Borough	0	0	1	0	0	26	0	0	0	27
East Bethlehem Township	4	0	6	1	14	860	0	0	0	885
East Finley Township	78	2	14	0	7	388	3	5	0	497
East Washington Borough	0	0	0	0	0	0	0	0	0	0

Table 4.3.7-6 Structures Over Mined Areas in Washington County by Generalized Land Use Type										
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UNKNOWN	UTILITIES	WATER	TOTAL
Elco Borough	0	0	0	0	0	0	0	0	0	0
Ellsworth Borough	0	9	1	0	2	449	0	0	0	461
Fallowfield Township	18	15	8	4	23	1,306	0	75	0	1,449
Finleyville Borough	0	0	0	0	0	0	0	0	0	0
Green Hills Borough	0	0	0	0	0	0	0	0	0	0
Hanover Township	0	0	0	0	0	0	0	1	0	1
Hopewell Township	0	0	0	0	0	10	0	0	0	10
Houston Borough	0	0	0	0	1	2	0	0	0	3
Independence Township	3	1	4	0	3	239	0	7	0	257
Jefferson Township	10	0	4	0	0	84	0	1	0	99
Long Branch Borough	5	0	0	0	3	207	0	1	0	216
Marianna Borough	1	4	0	1	0	254	0	0	1	261
McDonald Borough	0	0	0	0	0	47	55	0	0	102
Midway Borough	0	0	0	0	0	32	0	0	0	32
Monongahela, City of	0	0	0	0	4	258	0	0	0	262
Morris Township	13	0	2	0	2	68	0	2	0	87
Mount Pleasant Township	29	5	3	0	5	294	0	4	0	340
New Eagle Borough	0	0	0	0	0	78	0	0	0	78
North Bethlehem Township	40	6	7	2	4	391	0	5	0	455
North Charleroi Borough	0	0	0	0	0	113	0	0	0	113
North Franklin Township	4	0	1	0	0	214	0	0	0	219
North Strabane Township	179	115	385	14	132	4,980	0	7	0	5,812
Nottingham Township	33	8	21	0	9	837	0	2	0	910
Peters Township	102	530	157	0	75	7,328	1	4	0	8,197
Robinson Township	0	1	0	0	3	211	7	3	0	225
Roscoe Borough	0	0	0	0	0	0	0	0	0	0

Table 4.3.7-6 Structures Over Mined Areas in Washington County by Generalized Land Use Type

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UNKNOWN	UTILITIES	WATER	TOTAL
Smith Township	39	29	7	9	3	955	0	3	0	1,045
Somerset Township	55	33	17	1	21	928	0	12	0	1,067
South Franklin Township	5	1	3	0	0	240	0	0	0	249
South Strabane Township	71	128	57	48	38	1,820	0	4	0	2,166
Speers Borough	0	1	0	0	0	291	0	0	0	292
Stockdale Borough	0	0	0	0	0	0	0	0	0	0
Twilight Borough	1	0	0	0	1	24	0	0	0	26
Union Township	16	11	13	0	22	1,225	1	81	0	1,369
Washington, City of	0	2	0	0	1	218	0	0	0	221
West Bethlehem Township	43	12	7	0	6	460	0	7	0	535
West Brownsville Borough	0	0	0	0	2	232	0	0	0	234
West Finley Township	34	9	6	0	2	141	0	6	2	200
West Middletown Borough	0	0	0	0	0	0	0	0	0	0
West Pike Run Township	59	18	8	0	3	629	0	9	1	727
TOTAL	1,569	1,346	1,187	159	741	41,833	70	526	7	47,438

There are a few measures that can reduce the overall vulnerability to subsidence and sinkholes. Municipal governments may determine guidelines for construction in high-subsidence areas. A community can reduce its vulnerability to subsidence or sinkholes by implementing solutions such as land use controls, insurance programs, subsidence-resistant designs, or in the case of mine-related subsidence, installing structural reinforcements or mine filling. If a sinkhole occurs on private property, it is normally the responsibility of the property owner to initiate repairs. Homeowners' insurance often does not cover damages attributed to sinkholes. Since 1987, sinkhole insurance has been available within Pennsylvania and may serve to eliminate the financial burdens placed on the homeowner. Insurance coverage is available to both residential and commercial structures in amounts up to $50,000 for a single structure (PA DEP, 2021a).

Careful planning is the least-costly and most effective method for reducing vulnerability to subsidence hazards. Local and County officials should follow some of the following hazard mitigation measures: encourage local awareness of the subsidence hazards, compliance with or enactment of building codes and regulations that consider geologic factors, preparedness to respond to and cope with a geologic hazard occurrence, and encourage local property owners to purchase subsidence insurance. Municipalities could minimize the potential for sinkhole development through proper maintenance and updating of water utility lines. Zoning laws can also be enacted to regulate development within highly karst areas or former mining areas.

4.3.8. Tornado, Windstorm

4.3.8.1. Location and Extent

Tornadoes and windstorms can occur throughout Washington County, though events are usually localized. Severe thunderstorms may result in conditions favorable to the formation of numerous or long-lived tornadoes. Tornadoes can occur at any time during the day or night but are most frequent during late afternoon into early evening, the warmest hours of the day, and most likely to occur during the spring and early summer months of March through June.

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. 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 and windstorms are experienced on a more region-wide scale. While such winds usually accompany tornadoes, straight-line winds are caused by the movement of air from areas of higher pressure to areas of lower pressure. Stronger winds are the result of greater differences in pressure. Windstorms are generally defined with sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.

4.3.8.2. Range of Magnitude

Each year, tornadoes account for $400 million in damages and cause over 70 deaths nationally (National Geographic, 2019). While the extent of tornado damage is usually localized, the vortex of extreme wind associated with a tornado can result in some of the most destructive forces on Earth. Rotational wind speeds can range from 100 mph to more than 250 mph. In addition, the speed of forward motion can range from 0 to 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 damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

Damages and deaths can be especially significant when tornadoes move through populated, developed areas. The destruction caused by tornadoes ranges from minor to extreme damage depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as manufactured homes.

The Enhanced Fujita Scale, also known as the "EF-Scale," measures tornado strength and associated damages. The EF-Scale is an update to the earlier Fujita Scale, also known as the "F-Scale," that was published in 1971. It classifies United States tornadoes into six intensity

categories, as shown in Table 4.3.8-1, based upon the estimated maximum winds occurring within the wind vortex. Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon damage to buildings and structures. F-Scale categories with corresponding EF-Scale wind speeds are provided in Table 4.3.8-1 since the magnitude of previous tornado occurrences is based on the F-Scale.

Table 4.3.8-1 Enhanced Fujita Scale (EF-Scale) Categories with Associated Wind Speeds

FUJITA SCALE		ENHANCED 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

The types of damages that can be expected with each category of tornado are described in Table 4.3.8-2.

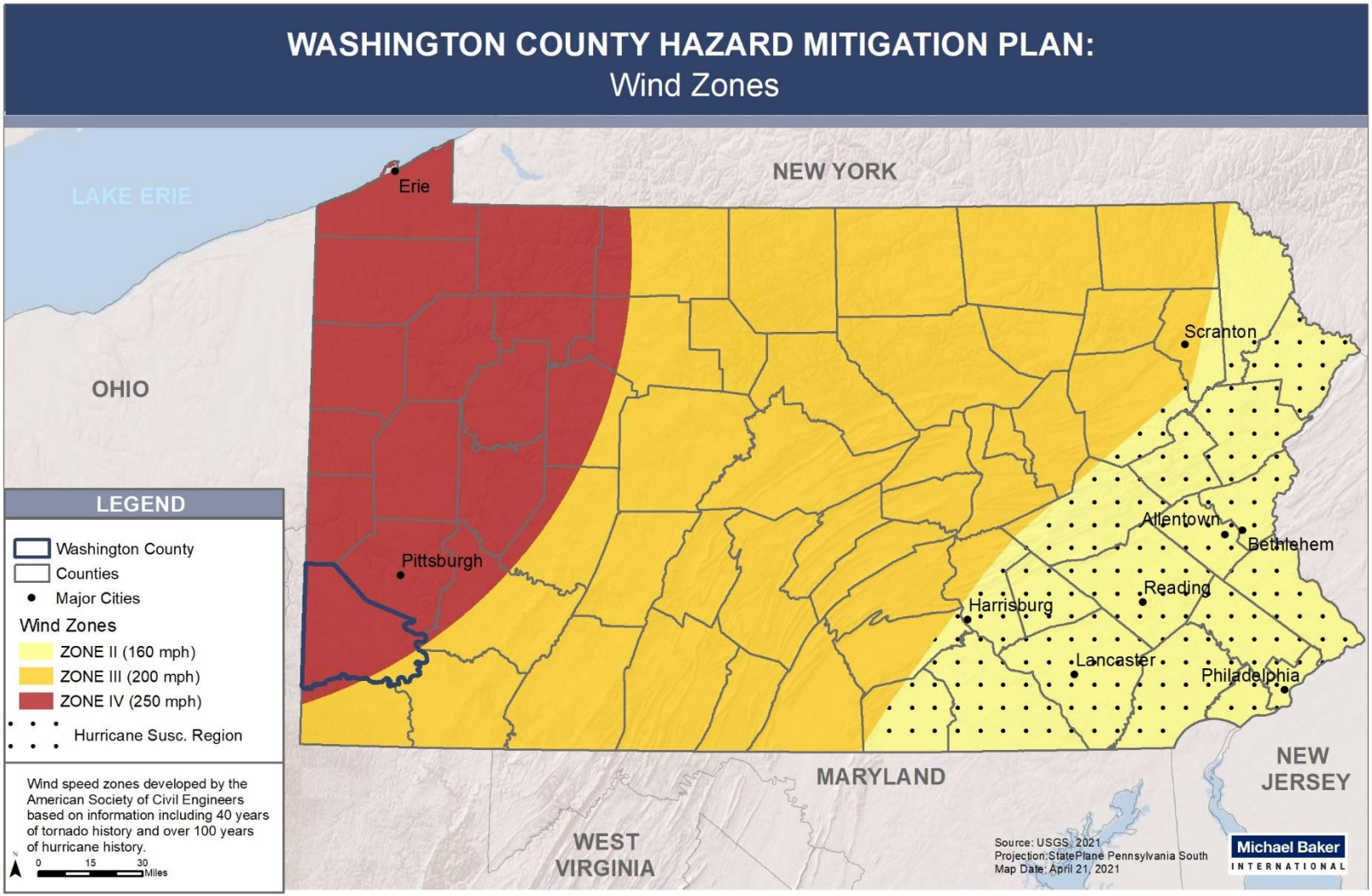
Table 4.3.8-2 Expected Tornado Damages

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; manufactured homes pushed off foundations or overturned; moving autos pushed off roads.
2	Considerable damage. Roofs torn off frame houses; manufactured 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.

Table 4.3.8-2 Expected Tornado Damages	
F OR EF SCALE	EXAMPLES OF POSSIBLE DAMAGE
5	Catastrophic damage. Well-built houses swept completely away, leaving only the slab foundations.

Figure 4.3.8-1 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. Washington County falls in Zone III and Zone IV, which are classified as 200 mph and 250 mph wind zones, respectively. This meaning design wind speeds for shelters and critical facilities should be able to withstand a three second gust of up to 200 mph and 250 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event.

Figure 4.3.8-1 Pennsylvania Wind Zones



The worst tornado event on record, occurred on July 15, 2004 in Campbelltown, Lebanon County. This F3 tornado, which had estimated wind speeds of 175-200 miles per hour, leveled 32 houses, severely damaged 37 homes, and an additional 50 homes suffered more minor damage. Two people were hospitalized from the tornado, one critically injured. While only on the ground for 10-15 minutes, the NCEI estimates that the tornado caused $18 million in property damage.

The worst tornado event in Washington County occurred on June 29, 1987. While not the highest F-Scale event ever experienced in Washington County, this event did cause both significant damage and at least one reported injury. In this event, an F1 tornado touched down for one half mile near Paris, Washington County. The tornado lifted roofs off houses and uprooted a number of trees. NCDC reports indicate 50 homes were damaged, ten heavily, with property damage of approximately $250,000. The injury during this event was due to flying glass.

Since tornado events are typically localized, environmental impacts are rarely widespread. The impacts of windstorms on the environment typically take place over a larger area. In either case, where these events occur, severe damage to plant species is likely. This includes uprooting or total destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Hazardous material facilities should meet design requirements for the wind zones identified in Figure 4.3.8-1 in order to prevent release of hazardous materials into the environment.

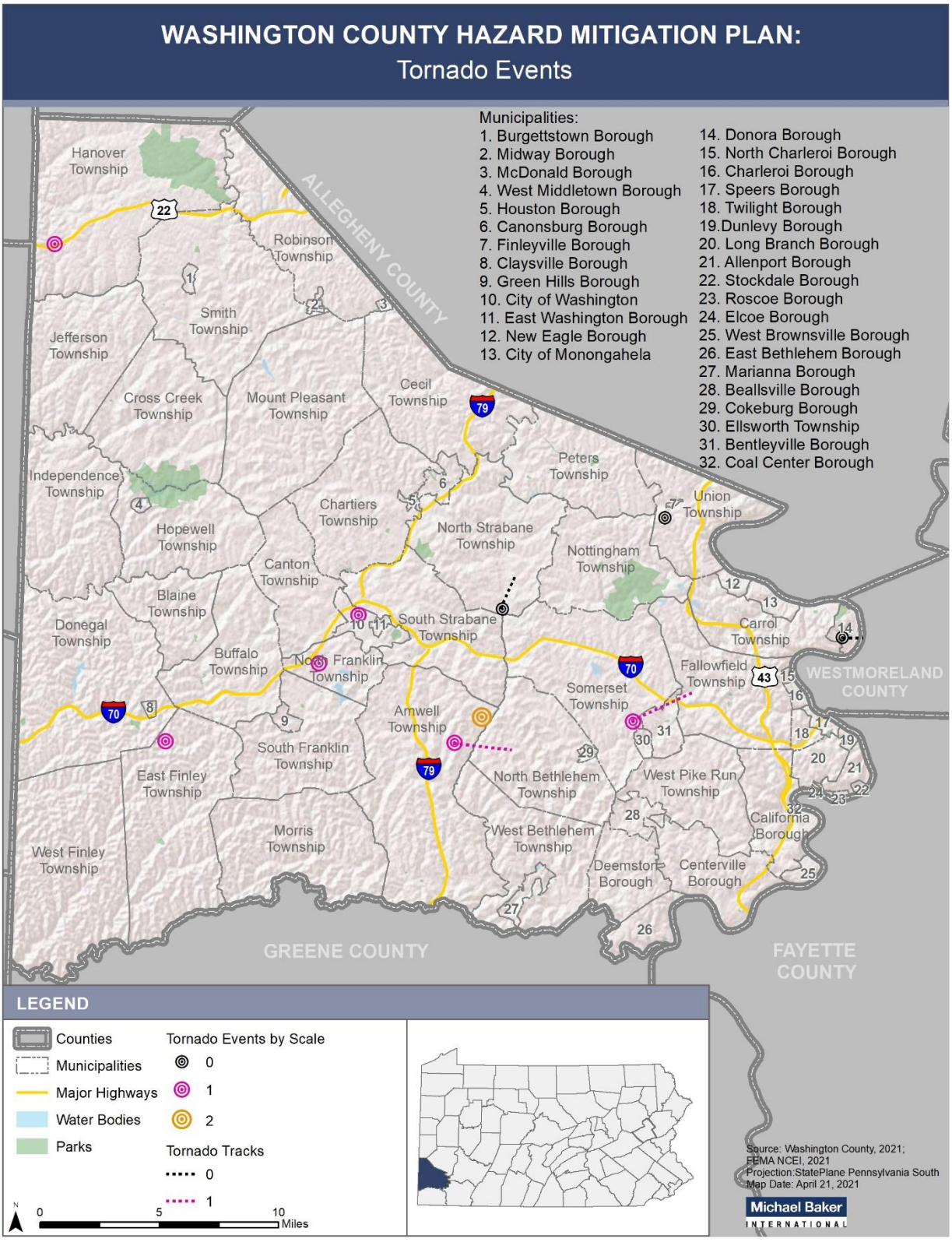
4.3.8.3. Past Occurrence

Tornadoes have occurred throughout Pennsylvania. Western and southeastern sections of the Commonwealth have been struck more frequently. Table 4.3.8-3 describes previous tornado events, and Figure 4.3.8-2 depicts locations of touchdowns and paths in Washington County.

Table 4.3.8-3 Previous Tornado Events Between 1950 and 2019 in Washington County (NCEI, 2019)

LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	ESTIMATED PROPERTY DAMAGE ($)
County-wide	5/10/1973	F1	0	3	25,000
County-wide	6/24/1976	F1	0	0	25,000
County-wide	5/31/1980	F1	0	0	25,000
County-wide	6/29/1987	F1	0	1	250,000
County-wide	8/9/1987	F1	0	0	250,000
County-wide	6/30/1990	F2	0	0	25,000
Eighty Four	9/27/2012	EF0	0	0	75,000
Donora	8/17/2016	EF0	0	0	10,000
Lone Pine	6/23/2017	EF1	0	0	60,000
Finleyville	6/3/2018	EF0	0	0	5,000
		TOTAL	0	4	750,000

Figure 4.3.8-2 Tornado History for Washington County (1950-2020)



Windstorm events may be the result of thunderstorms, hurricanes, tropical storms, winter storms, or nor'easters. 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. In 2019 alone, windstorm events caused $69,000 in damage. Previous high wind events in the County are summarized in Table 4.3.8-4.

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Washington County	9/5/1975	52	0
Washington County	8/8/1979	56	0
Washington County	9/14/1990	50	0
Finleyville	5/12/1993	52	0
Roscoe	5/12/1993	52	0
Beallsville	7/15/1995	52	0
Washington County	4/30/1996	51	0
Washington (Zone)	1/18/1999	60	25,000
Washington, City of	4/9/1999	50	2,000
Washington (Zone)	4/16/1999	50	0
Marianna	5/18/1999	50	3,000
Strabane	8/13/1999	70	50,000
Washington (Zone)	1/10/2000	50	4,000
Washington (Zone)	1/10/2000	50	2,000
Washington (Zone)	12/14/2001	50	5,000
Washington (Zone)	3/8/2003	55	0
Claysville	4/4/2003	55	1,000
Prosperity	4/4/2003	55	1,000
McMurray	6/8/2003	52	1,000
McMurray	6/8/2003	55	5,000
Hickory	6/8/2003	53	10,000
Ellsworth	7/4/2003	52	2,000
McMurray	7/7/2003	50	1,000
Fredericktown	7/8/2003	50	1,000
Washington, City of	7/8/2003	50	1,000
Washington, City of	7/8/2003	50	1,000
Midland	7/8/2003	50	1,000
Washington County	7/8/2003	52	2,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Independence	7/10/2003	50	5,000
Hickory	7/18/2003	50	1,000
Washington, City of	7/18/2003	50	1,000
Burgettstown	7/18/2003	50	1,000
Washington (Zone)	7/21/2003	50	1,000
Washington, City of	8/26/2003	50	1,000
Centerville	8/27/2003	50	0
Cecil	8/27/2003	50	2,000
Avella	8/27/2003	50	2,000
Washington, City of	8/27/2003	50	2,000
Burgettstown	11/12/2003	50	1,000
Claysville	4/25/2004	50	0
North Charleroi	5/17/2004	50	10,000
Fredericktown	5/21/2004	50	0
Claysville	5/21/2004	50	0
Burgettstown	6/14/2004	50	2,000
Canonsburg	6/15/2004	50	3,000
Washington, City of	6/17/2004	50	2,000
Washington, City of	8/4/2004	50	0
Washington, City of	8/19/2004	50	0
Washington, City of	8/20/2004	52	2,000
Washington (Zone)	12/1/2004	50	8,000
Burgettstown	6/14/2005	52	5,000
Burgettstown	6/28/2005	50	8,000
Deemstown	6/28/2005	50	3,000
Bentleyville	6/30/2005	50	15,000
Charleroi	7/12/2005	50	6,000
Bentleyville	7/13/2005	50	3,000
West Alexander	7/25/2005	80	80,000
Canonsburg	8/7/2005	50	6,000
Cecil	8/20/2005	50	4,000
Canonsburg	8/20/2005	52	30,000
California	8/20/2005	50	1,000
County-wide	11/6/2005	50	15,000
County-wide	11/6/2005	50	20,000
Washington, City of	11/9/2005	50	8,000
California	4/14/2006	50	3,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Washington, City of	4/14/2006	50	5,000
McDonald	7/30/2006	50	2,000
County-wide	8/3/2006	50	14,000
Bishop	10/4/2006	50	0
Washington (Zone)	12/1/2006	55	30,000
Washington, City of	3/14/2007	50	15,000
Marianna	6/8/2007	50	3,000
Washington County	6/19/2007	50	3,000
Claysville	6/21/2007	50	3,000
Burgettstown	6/27/2007	50	2,000
Cecil	8/9/2007	50	50,000
Washington, City of	8/9/2007	50	75,000
Mt Herman	8/9/2007	50	50,000
Marianna	8/9/2007	50	50,000
Washington (Zone)	1/30/2008	50	50,000
Washington (Zone)	2/6/2008	50	50,000
Canonsburg	6/13/2008	50	75,000
McMurray	6/13/2008	50	50,000
Canonsburg	6/29/2008	50	125,000
South Strabane	6/29/2008	50	75,000
Bentleyville	6/29/2008	50	50,000
Independence	7/21/2008	50	75,000
Gretna	7/31/2008	50	50,000
Washington (Zone)	9/14/2008	50	150,000
West Finley	2/11/2009	50	10,000
Washington, City of	2/11/2009	50	0
Washington (Zone)	2/12/2009	50	100,000
Donora	5/28/2009	50	35,000
Denningsville	6/26/2009	50	25,000
Washington (Zone)	12/9/2009	50	0
McDonald	4/16/2010	50	75,000
Bentleyville	4/16/2010	55	75,000
Finleyville	6/4/2010	50	50,000
West Middletown	6/4/2010	50	25,000
Strabane	6/4/2010	50	10,000
Thomas	6/4/2010	50	50,000
West Alexander	8/4/2010	55	50,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Donora	8/4/2010	55	30,000
Charleroi	8/4/2010	50	35,000
Canonsburg	9/22/2010	50	5,000
Linden	2/28/2011	50	25,000
Canonsburg	2/28/2011	50	50,000
Jewell	2/28/2011	50	15,000
Wylandville	2/28/2011	50	15,000
Charleroi	3/23/2011	50	15,000
Charleroi	3/23/2011	50	10,000
Monongahela	4/26/2011	50	50,000
Washington, City of	7/11/2011	50	15,000
Donaldsons Crossroads	7/11/2011	50	10,000
Ginger Hill	7/18/2011	50	2,000
Bower Hill	8/19/2011	50	0
Venetia	8/19/2011	50	25,000
Monongahela	8/19/2011	50	50,000
Finleyville	8/19/2011	50	25,000
Finleyville	8/19/2011	50	25,000
Donora	8/19/2011	50	35,000
Monongahela	8/19/2011	50	25,000
Washington (Zone)	2/24/2012	50	0
Claysville	6/18/2012	50	5,000
Washington, City of	6/29/2012	60	2,500
Joffre	8/9/2012	50	500
Atlasburg	1/30/2013	50	10,000
Banetown	1/30/2013	50	10,000
Joffre	1/30/2013	50	10,000
Cecil	1/30/2013	50	10,000
Bissell	1/30/2013	50	10,000
Bower Hill	1/30/2013	50	0
Walkertown	1/30/2013	50	10,000
Buffalo	5/21/2013	50	2,000
Purdy	5/22/2013	50	1,000
Washington Co. Airport	6/13/2013	50	1,000
Washington County	6/13/2013	50	2,000
Glyde	6/18/2013	50	500
Langeloth	6/25/2013	50	2,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Glyde	6/25/2013	50	2,000
Independence	6/25/2013	50	2,000
Linden	6/25/2013	50	2,000
Canonsburg	6/25/2013	50	2,000
McAdams	6/25/2013	50	2,000
Gale	6/25/2013	50	5,000
Dunlevy	6/28/2013	50	1,000
South Strabane	6/28/2013	50	2,000
Venice	7/8/2013	50	15,000
Canonsburg	7/8/2013	50	15,000
West Alexander	7/10/2013	71	0
Avella	7/10/2013	50	10,000
Washington, City of	7/10/2013	50	2,000
Finney	7/10/2013	50	15,000
Claysville	7/10/2013	50	10,000
West Alexander	7/10/2013	50	25,000
Avella	7/23/2013	50	5,000
Washington County	7/23/2013	50	5,000
Donora	7/23/2013	50	10,000
Strabane	11/1/2013	50	40,000
Roscoe	11/1/2013	50	50,000
Hamilton	11/17/2013	50	25,000
Washington, City of	11/17/2013	50	10,000
Banetwon	11/17/2013	50	25,000
Washington, City of	12/22/2013	50	1,000
Van Voorhis	5/7/2014	50	2,000
Coal Center	5/7/2014	50	1,500
JEWELL	5/7/2014	50	500
East Finley	6/11/2014	50	10,000
Good Intent	6/11/2014	50	10,000
Pleasant Grove	6/11/2014	50	5,000
Washington, City of	6/11/2014	50	20,000
Washington West	6/11/2014	50	5,000
McConnells Mill	6/11/2014	50	10,000
Morganza	6/11/2014	50	3,000
Hendersonville	6/11/2014	50	3,000
Lawrence Hills	6/11/2014	50	5,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Lowhill	6/11/2014	50	3,000
Lover	6/11/2014	50	2,000
West Brownsville	6/11/2014	50	3,000
Roscoe	6/11/2014	50	5,000
Sudan	6/11/2014	50	2,000
Frye	6/11/2014	50	2,000
Speers	6/11/2014	50	0
Glennes Heights	6/11/2014	50	5,000
Roscoe	6/11/2014	50	15,000
Donora	6/11/2014	50	15,000
Allenport	6/11/2014	50	15,000
Burgettstown	6/18/2014	50	2,000
Hendersonville	7/13/2014	50	3,000
West Alexander	7/30/2014	50	1,000
Claysville	7/30/2014	50	5,000
Washington (Zone)	12/24/2014	45	2,000
Acheson	4/9/2015	50	5,000
Vienna	4/9/2015	50	10,000
Rea	4/9/2015	50	2,000
Independence	4/9/2015	50	2,000
Cherry Vly	4/9/2015	50	15,000
Midway	4/9/2015	50	5,000
Mc Donald	4/9/2015	50	10,000
Midway	4/9/2015	50	10,000
Manifold	4/9/2015	50	10,000
Mc Donald	4/9/2015	50	10,000
Venice	4/9/2015	50	5,000
Mc Govern	4/9/2015	50	5,000
Tylerdale	4/9/2015	50	2,000
Bishop	4/9/2015	50	10,000
Venice	4/9/2015	50	5,000
Muse	4/9/2015	50	2,000
Westland	6/14/2015	50	5,000
Bissell	6/14/2015	50	5,000
Taylorstown	6/18/2015	50	5,000
Florence	6/23/2015	50	8,000
Bertha	6/23/2015	50	10,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Burgettstown	6/23/2015	50	15,000
Mc Murray	6/23/2015	50	8,000
Taylorstown	6/23/2015	50	5,000
Donora	6/23/2015	50	5,000
Taylorstown	7/7/2015	50	500
Bishop	8/3/2015	50	10,000
Gastonville	8/3/2015	50	8,000
Coal Bluff	8/3/2015	50	10,000
Claysville	8/3/2015	50	0
Taylorstown	8/3/2015	50	5,000
Taylorstown	8/3/2015	50	5,000
Taylorstown Station	8/3/2015	50	10,00
Washington Co Arpt	8/3/2015	50	10,00
Banetown	8/3/2015	50	10,00
Manifold	8/3/2015	50	5,00
Twilight	8/3/2015	50	5,00
Mc Connells Mill	6/6/2016	50	35,000
Hamilton	6/6/2016	50	30,000
Fredericktown	6/16/2016	50	15,000
Courtney	7/23/2016	50	5,000
Deemston	7/23/2016	61	5,000
Besco	7/23/2016	50	5,000
Ellsworth	8/28/2016	50	5,000
Venetia	8/28/2016	50	25,000
Southview	3/1/2017	50	5,000
Burgettstown	4/27/2017	50	5,000
Florence	5/1/2017	50	1,000
Vienna	5/1/2017	50	1,000
Glennes Hgts	5/1/2017	50	2,000
Washington	6/23/2017	50	1,000
Harts Mill	6/23/2017	50	1,000
South Strabane	6/23/2017	50	15,000
Monongahela	6/23/2017	50	1,000
Scenery Hill	7/7/2017	50	2,000
Burgettstown	8/4/2017	50	2,050
Hickory	8/4/2017	50	2,050
Burgettstown	8/19/2017	50	2,500

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Bishop	8/19/2017	50	2,500
Mc Donald	8/22/2017	50	2,000
Bishop	8/22/2017	50	1,000
Penowa	8/22/2017	45	10,000
Vanceville	8/22/2017	50	500
Charleroi	8/22/2017	50	1,000
Bellfield	4/3/2018	50	5,000
Eldersville	4/3/2018	50	2,500
Venetia	5/12/2018	50	0
Thomas	5/12/2018	56	5,000
Venetia	5/12/2018	56	8,000
Venetia	5/12/2018	50	2,000
Claysville	5/13/2018	50	2,000
Claysville	5/13/2018	50	2,000
Claysville	5/13/2018	55	5,000
Tenmile	5/13/2018	50	0
Besco	5/13/2018	56	5,000
East Finley	5/14/2018	50	500
Mc Donald	5/22/2018	50	250
Muse	5/22/2018	50	250
Morganza	5/22/2018	50	250
Mc Murray	5/22/2018	50	500
Canonsburg	5/22/2018	50	250
Brevard	6/3/2018	50	500
Gabby Hgts	6/3/2018	50	500
Charleroi	6/3/2018	50	1,000
Joffre	6/13/2018	50	0
Mc Donald	7/2/2018	55	0
Venetia	7/15/2018	50	0
Bower Hill	7/15/2018	50	0
Joffre	9/21/2018	50	0
Washington (Zone)	2/24/2019	50	0
Florence	5/18/2019	50	0
Five Pts	6/24/2019	50	0
Bishop	6/24/2019	50	0
Robinson	6/27/2019	50	1,000
Candor	6/27/2019	50	0

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)

LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Candor	6/27/2019	50	3,000
Mc Adams	6/27/2019	60	5,000
Midway	6/27/2019	50	1,000
Glennes Hgts	6/29/2019	50	2,000
Sudan	6/29/2019	50	2,000
Independence	6/29/2019	50	2,000
South Strabane	6/29/2019	50	2,000
Penowa	6/29/2019	50	2,000
Glennes Hgts	6/29/2019	50	2,000
Penowa	6/29/2019	50	2,000
Independence	6/29/2019	50	2,000
Budaville	6/29/2019	50	5,000
West Alexander	6/29/2019	50	5,000
Claysville	6/29/2019	50	0
Claysville	6/29/2019	50	5,000
Tenmile	6/29/2019	50	0
Cross Creek	7/2/2019	50	0
Studa	7/2/2019	50	0
Atlasburg	7/2/2019	50	0
Washington	7/2/2019	50	0
Gretna	7/2/2019	50	0
Van Buren	7/2/2019	50	0
California	7/2/2019	50	0
West Middletown	7/11/2019	50	0
Taylorstown Station	8/2/2019	50	2,000
Charleroi	8/8/2019	50	1,000
Roscoe	8/18/2019	50	10,000
California	8/18/2019	50	5,000
Jewell	8/18/2019	50	5,000
Washington (Zone)	10/31/2019	43	5,000
Atlasburg	3/28/2020	50	3,000
Hickory	3/28/2020	50	5,000
Mc Murray	3/28/2020	50	5,000
Walkertown	3/28/2020	50	5,000
West Brownsville	3/28/2020	50	5,000
Donaldsons Xrds	4/8/2020	50	1,000
Bishop	4/8/2020	50	10,000

Table 4.3.8-4 Previous Windstorm Events Greater Than 50 Knots in Washington County Between 1950 And 2021 (NCEI, 2021)			
LOCATION*	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Mc Murray	6/4/2020	50	2,000
Speers	6/4/2020	50	2,000
Speers	6/4/2020	50	2,000
Donora	6/10/2020	50	5,000
Thomas	6/21/2020	50	10,000
East Washington	6/21/2020	50	10,000
East Washington	6/21/2020	50	10,000
Amity	6/21/2020	50	2,000
Eighty Four Arpt	6/21/2020	50	10,000
Cherry Vly	7/7/2020	50	0
Cecil	7/9/2020	50	0
Mt Herman	7/9/2020	50	0
Laboratory	7/9/2020	50	0
Tylerdale Jct	7/9/2020	50	0
South Strabane	7/9/2020	50	0
Midway	7/9/2020	50	0
Van Voorhis	7/10/2020	50	0
Coal Center	8/13/2020	50	0
		TOTAL	**3.563M**
*Location as stated on the NOAA Storm Events Database			

4.3.8.4. Future Occurrence

Seven tornadoes were reported for Washington County for the entire 1950–2021period in NCEI. Therefore, the annual probability of being in the path of a tornado in Washington 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. According to NCEI, there have been over 346 wind events in Washington County between 1950 and 2021. The probability of tornadoes and windstorms in Washington County can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.8.5. Vulnerability Assessment

For tornadoes or high winds, aged and dilapidated structures or structures not built to applicable building codes are more susceptible to damage. Manufactured 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 manufactured homes.

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 Washington 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.

All critical facilities in Washington County are at least somewhat vulnerable to tornadoes and windstorms. Since high wind events may affect the entire County, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Evaluation criteria include age of the building (and what building codes may have been in effect at the time), type of construction, and condition of the structure (i.e., how well has the structure been maintained). Detailed structure attributes were not available for this study, so it was difficult to determine the exact number and types of structures within Washington County that have heightened vulnerability to wind hazards.

Manufactured housing (i.e. a mobile home or trailer) 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, 2010)." 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.

Table 4.3.8-5 below displays the number of manufactured housing units per municipality in Washington County.

Table 4.3.8-5 Manufactured Homes Per Jurisdiction in Washington County (Washington County GIS 2014)			
MUNICIPALITY	TOTAL RESIDENTIAL STRUCTURES	TOTAL MANUFACTURED HOMES	PERCENT MANUFACTURED HOMES
Allenport Borough	270	0	0.0%
Amwell Township	1,664	2	0.1%
Beallsville Borough	227	1	0.4%
Bentleyville Borough	1,088	3	0.3%
Blaine Township	273	0	0.0%
Buffalo Township	869	1	0.1%
Burgettstown Borough	668	0	0.0%
California Borough	1,789	0	0.0%
Canonsburg Borough	4,070	0	0.0%
Canton Township	3,726	6	0.2%
Carroll Township	2,439	2	0.1%
Cecil Township	5,516	0	0.0%
Centerville Borough	1,685	0	0.0%
Charleroi Borough	2,099	0	0.0%
Chartiers Township	3,600	1	0.0%
Claysville Borough	337	0	0.0%
Coal Center Borough	85	0	0.0%
Cokeburg Borough	367	0	0.0%
Cross Creek Township	761	0	0.0%
Deemston Borough	362	0	0.0%
Donegal Township	1,244	1	0.1%
Donora Borough	2,553	0	0.0%
Dunlevy Borough	216	2	0.9%
East Bethlehem Township	1,258	0	0.0%
East Finley Township	639	0	0.0%
East Washington Borough	653	0	0.0%
Elco Borough	149	0	0.0%
Ellsworth Borough	460	0	0.0%
Fallowfield Township	2,048	2	0.1%
Finleyville Borough	212	0	0.0%
Green Hills Borough	8	0	0.0%
Hanover Township	1,231	6	0.5%

Table 4.3.8-5 Manufactured Homes Per Jurisdiction in Washington County (Washington County GIS 2014)			
MUNICIPALITY	TOTAL RESIDENTIAL STRUCTURES	TOTAL MANUFACTURED HOMES	PERCENT MANUFACTURED HOMES
Hopewell Township	423	0	0.0%
Houston Borough	569	0	0.0%
Independence Township	759	0	0.0%
Jefferson Township	536	0	0.0%
Long Branch Borough	248	0	0.0%
Marianna Borough	266	0	0.0%
McDonald Borough	960	0	0.0%
Midway Borough	416	2	0.5%
Monongahela, City of	2,093	0	0.0%
Morris Township	477	0	0.0%
Mount Pleasant Township	1,676	0	0.0%
New Eagle Borough	988	4	0.4%
North Bethlehem Township	773	1	0.1%
North Charleroi Borough	586	0	0.0%
North Franklin Township	1,960	0	0.0%
North Strabane Township	6,094	1	0.0%
Nottingham Township	1,287	1	0.1%
Peters Township	8,286	0	0.0%
Robinson Township	903	0	0.0%
Roscoe Borough	403	0	0.0%
Smith Township	2,173	0	0.0%
Somerset Township	1,308	3	0.2%
South Franklin Township	1,458	6	0.4%
South Strabane Township	3,934	0	0.0%
Speers Borough	606	0	0.0%
Stockdale Borough	252	1	0.4%
Twilight Borough	106	0	0.0%
Union Township	2,797	1	0.0%
Washington, City of	5,585	1	0.0%

Table 4.3.8-5 2014)	Manufactured Homes Per Jurisdiction in Washington County (Washington County GIS		
MUNICIPALITY	TOTAL RESIDENTIAL STRUCTURES	TOTAL MANUFACTURED HOMES	PERCENT MANUFACTURED HOMES
West Bethlehem Township	697	0	0.0%
West Brownsville Borough	529	0	0.0%
West Finley Township	425	0	0.0%
West Middletown Borough	85	0	0.0%
West Pike Run Township	826	0	0.0%
TOTAL	93,050	48	0.1%

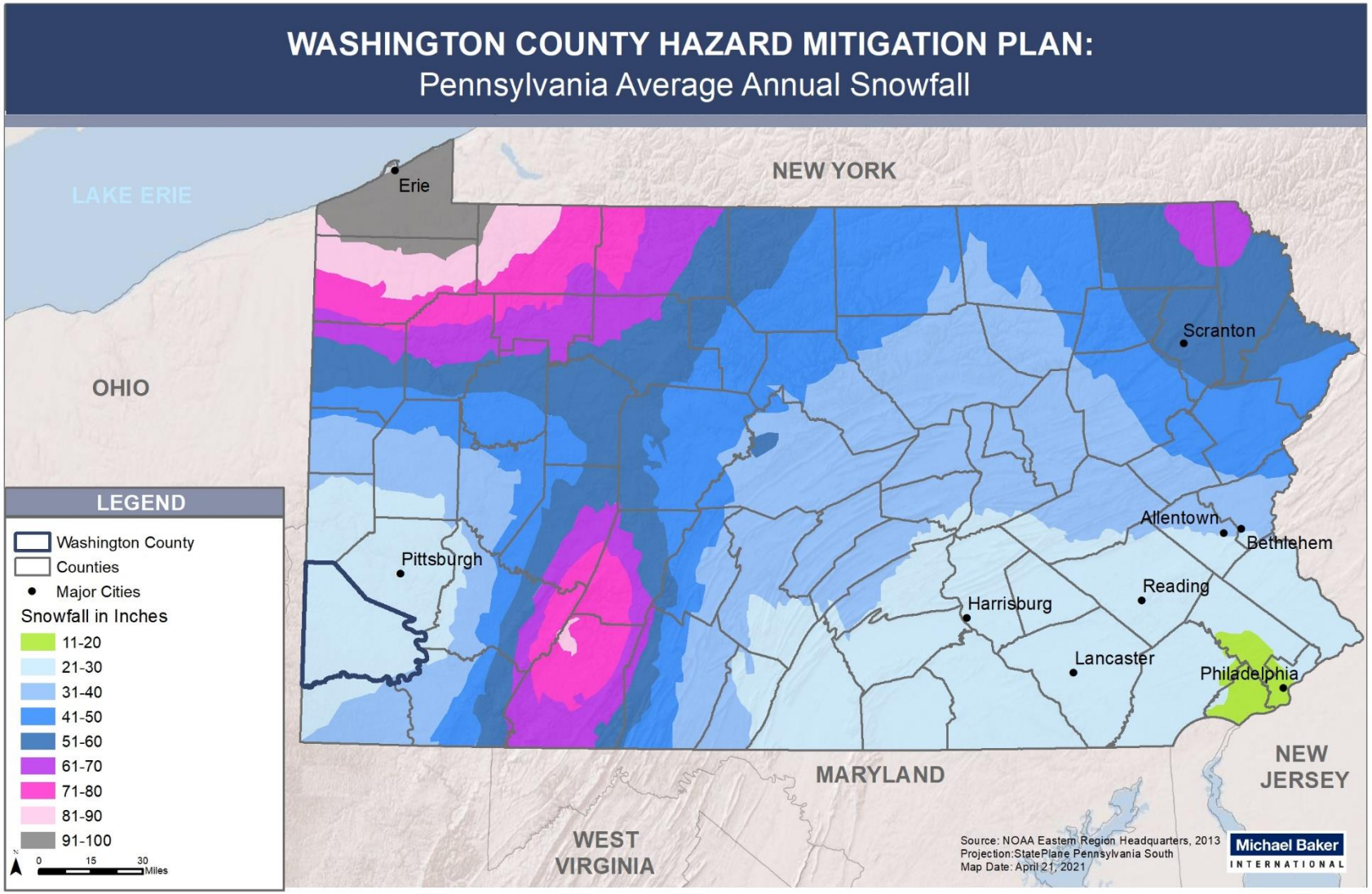
Environmental impacts from tornadoes can include debris in streams, wetlands, and other sensitive environmental features. Tree damage is commonly seen after high wind events. Hazardous material facilities should meet design requirements for the wind zones identified in Figure 4.3.5-1 in order to prevent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

4.3.9. Winter Storm

4.3.9.1. Location and Extent

Heavy snow or ice occurs throughout the Commonwealth of Pennsylvania. Every municipality in Washington County is affected by these storms. Washington 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 21 and 30 inches of snow annually (see the map below). This was the most current data available at the time of this HMP Update.

Figure 4.3.9-1 Mean Annual Snowfall for Pennsylvania and Washington County



4.3.9.2. 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 Washington 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 incidents and trapped vehicles), and technological problems (communication system outages and overload). Winter storms can adversely affect roadways, utilities, business activities, and can cause loss of life, frostbite, or freezing.

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

- Heavy Snowstorm: Accumulations of four inches or more in a six-hour period, or six inches or more in a 12-hour period.
- Sleet Storm: Sleet is formed when snow falling to the earth partially melts as it passes through a layer of warm air. The precipitation then passes through a cold layer of air and refreezes into solid pellets. Sleet causes surfaces to become slippery, posing hazards to pedestrians and motorists.
- Ice Storm: An ice storm occurs when rain freezes upon impact with the ground or other objects such as trees and power lines. Heavy accumulations of ice can bring down trees and topple utility poles, disrupting power and communication for days while crews make the necessary repairs. The icy conditions are also dangerous for pedestrians and vehicular traffic.
- Blizzard: According to the National Weather Service, a blizzard is a severe snowstorm that occurs when winds reach 35mph or more. The blowing snow reduces visibility to less the one-quarter of a mile for at least three hours.
- Severe Blizzard: Wind velocity of 45 mph, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

4.3.9.3. Past Occurrence

The Commonwealth of Pennsylvania has a long history of winter storms. Winter storms generally occur more than once each year in the County.

Washington County has experienced many major winter storms. In January 1977, January and February 1994, January 1996, and February 2003, statewide Emergency Declarations and Presidential Disaster Declarations were issued because of heavy snow and severe winter storms. Emergency Declarations was also issued in March 1993 due to blizzard conditions –

high winds and snow. In January 1999, January 1996, January 1994, and March 1993, deep snows, high winds, and cold temperatures resulted in a state of emergency in Washington County. Many County residents were without power for several days. Some residents even lost natural gas service. Many County roads and highways were impassable for as long as a week. The Department of Public Safety utilized the services of volunteers, County employees, and the Pennsylvania National Guard to help clear roads and relocate residents. The Department of Public Safety also has had to coordinate fuel delivery to residents during snow events.

One of the most severe winter weather seasons occurred in the winter of 1993-1994, when the state was hit by a series of protracted winter storms. The severity and nature of these storms, combined with record-breaking frigid temperatures, posed a major threat to the lives, safety, and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals, and nursing homes.

The first of these devastating winter storms occurred in early January, with record snowfall depths (in excess of 33 inches in the southwest and south-central portions of the Commonwealth), strong winds, and sleet/freezing rain. Numerous storm-related power outages were reported, and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed, affecting the southeastern portion of the Commonwealth, which closed major arterial roads and downed trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. Officials from PP&L stated that this was the worst winter storm in the history of the company, and related damage-repair costs exceeded $5,000,000.

Serious power supply shortages continued through mid-January because of record cold temperatures at many places, causing sporadic power generation outages across the Commonwealth. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York, and Virginia experienced 15- to 30-minute rolling blackouts, threatening the lives of people and the safety of the facilities in which they resided. Power and fuel shortages affecting Pennsylvania and the East Coast power grid system required the governor to recommend power conservation measures be taken by all commercial, residential, and industrial power consumers.

The record cold conditions resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. Additionally, the extreme cold, in conjunction with accumulations of frozen precipitation, resulted in acute shortages of road salt. As a result, trucks were dispatched to haul salt from New York to expedite deliveries to PennDOT storage sites.

During January and February 1994, Pennsylvania experienced at least 17 regional or statewide winter storms. The consequences of these disasters resulted in the need for intervention by the president in an effort to alleviate the severity of the hardship and to aid the recovery of the hardest-hit counties.

In January 1996, another series of severe winter storms with 27- and 24-inch accumulated snow depths was followed by 50 to 60 degree temperatures, resulting in rapid melting and flooding (as described in the preceding section on flood hazard vulnerability assessment). Washington County documented its greatest snowfall in history that year: 87.7 inches. Included in these storms was the blizzard of 1996, which dumped as much as 40 inches of snow on some parts of Pennsylvania. Many communities could not maintain emergency corridors necessary to sustain operations at critical health and safety facilities. President Clinton included the state in a list of federally declared disaster areas to receive funding for emergency snow removal.

Tables 4.3.9-1 presents a history of the winter storms that have affected Washington County prior to 1996, when NCEI began keeping comprehensive winter storm event records.

Table 4.3.9-1 Previous Winter Storms Events in Washington County from 1972-1995 (Washington County Department of Public Safety)

DATE	TYPE OF STORM	AREAS AFFECTED	EMERGENCY DECLARED
1/20/1972	Heavy Snow	Statewide	Governor
12/2/1974	Heavy Snow and Power Outage	Southwestern Counties	Governor
1/9/1977	Fuel Shortage and Severe Weather	Washington and 20 other PA counties	President and Governor
1/20/1978	Heavy Snow	Statewide	Governor
2/6/1978	Blizzard	Statewide	Governor
3/1993	Blizzard	Statewide	President and Governor
1/1994	Severe Winter Storms	Statewide	President and Governor
1/1995	Heavy Snow	Statewide	None

The NCEI data on past occurrences for winter storm lists events since 1996.. These winter storm events are listed in Table 4.3.9-2 below.

Table 4.3.9-2 Previous Winter Storm Events Impacting Washington County Since 1995 (NCEI, 2021)

LOCATION	DATE	TYPE	ESTIMATED PROPERTY DAMAGE ($)
Washington County	1/6/1996	Heavy Snow	0
Washington County	2/13/1997	Ice Storm	0
Washington County	1/2/1999	Winter Storm	0
Washington County	1/8/1999	Winter Storm	0

Table 4.3.9-2 Previous Winter Storm Events Impacting Washington County Since 1995 (NCEI, 2021)			
LOCATION	DATE	TYPE	ESTIMATED PROPERTY DAMAGE ($)
Washington County	1/13/1999	Winter Storm	0
Washington County	3/9/1999	Heavy Snow	0
Washington County	12/13/2000	Winter Storm	0
Washington County	1/20/2001	Heavy Snow	0
Washington County	1/7/2002	Heavy Snow	0
Washington County	12/11/2002	Ice Storm	0
Washington County	2/16/2003	Heavy Snow	0
Washington County	12/5/2003	Heavy Snow	0
Washington County	12/14/2003	Heavy Snow	0
Washington County	2/5/2004	Ice Storm	0
Washington County	1/22/2005	Heavy Snow	0
Washington County	3/1/2005	Heavy Snow	0
Washington County	12/15/2005	Ice Storm	0
Washington County	2/13/2007	Ice Storm	0
Washington County	1/27/2009	Ice Storm	0
Washington County	2/5/2010	Heavy Snow	0
Washington County	2/21/2011	Heavy Snow	0
Washington County	1/20/2012	Ice Storm	0
Washington County	12/26/2012	Ice Storm	0
Washington County	3/5/2013	Heavy Snow	0
Washington County	2/4/2014	Winter Storm	0
Washington County	1/22/2016	Heavy Snow	0
Washington County	1/12/2018	Winter Storm	0
Washington County	2/07/2018	Winter Storm	0
Washington County	12/01/2020	Winter Storm	0
Washington County	12/16/2020	Winter Storm	0
Washington County	2/08/2021	Winter Storm	0
		TOTAL	0

4.3.9.4. Future Occurrence

The severity and frequency of major winter storms is expected to remain fairly constant. However, due to increased dependence on various modes of transportation and use of public utilities for light, heat, and power, the disruption from these storms is more significant today than in the past.

The future occurrence of climatic events cannot be predicted exactly. As noted in the table above, the County has only been affected by four winter storm events in one year - 1999. Given this record of reported events, it is safe for planning purposes to assume that in an average year the County can expect to experience one or two winter storm events. The future

occurrence of winter storms hazard can be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.9.5. Vulnerability Assessment

In Washington County, wintertime snow accumulations are expected and normal. The most common, but potentially serious, effects of very heavy snowstorms with accumulations exceeding six or more inches in a 12-hour period are snow drifts causing road closures, traffic incidents, interruptions in power supply and communications, and the failure of inadequately designed and/or maintained roofing systems. Some rural areas of the County are susceptible to isolation due to the loss of telephone communications and road closings. Power failure and interruption of water supplies are common from ice storms, heavy snow, and blizzard conditions.

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.

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 Washington County are exposed to heavy snow and ice. 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. Over 29% of Washington County's housing units were built prior to 1940 (ACS 2019).

HUMAN-MADE HAZARDS

4.3.10. Civil Disturbance

4.3.10.1. 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 (Bohstedt, 2014).
- Economic Collapse, Recession; Very slow or negative growth (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. Washington County is susceptible to these events based on the presence of government buildings and educational institutions.

4.3.10.2. 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. Often that which was intended to be a peaceful demonstration to the public and the government can escalate into general chaos. 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 (Blumer, 1946):

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
3. 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 group action.
4. 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 crowd type is a group assembled to protest a cause.
5. 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 tend to be impulsive and highly emotional, and require only minimal stimulation to arouse them to 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, 2008):

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

The worst-case scenario for Washington County would be an aggressive crowd or an expressive mob protesting on or within a major thoroughfare, most likely formed near a government building.

4.3.10.3. Past Occurrence

Washington County does not have a comprehensive dataset of civil disturbance related events. It is projected that minor civil disturbance events have occurred throughout the County.

In April 2018, a riot was reported in California Borough at the intersection of Mechanic Street and Third Street. At one point at least ten people were involved in the fight in a nearby playground (Matoney, 2018). In September 2018, a man was severely injured outside a bar in Chartiers Township as result of a "gang-style" assault and riot (Beveridge, 2019a). In both instances, law enforcement was needed to break up the fights.

In summer 2020, protests broke out nationwide after the death of George Floyd. Witnesses note that May 31st protests in nearby Pittsburgh turned violent, while protests in Washington County remained peaceful. About 30 protestors gathered in front of the Washington County Courthouse for several hours (KDKA, 2020).

In September 2020, a rally was hosted in support of the reelection campaign for President Donald Trump. The event was met with supporters for President Joe Biden, who spent the afternoon outside Trinity Schools protesting the rally. Trinity Schools moved all operations online for the day to keep children away from protest areas (WPXI, 2020).

4.3.10.4. Future Occurrence

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

4.3.10.5. Vulnerability Assessment

The vulnerability of individual jurisdictions is difficult to determine because civil disturbance hazards are tied to the current political and economic climate. A jurisdiction that is very vulnerable one month may be less vulnerable the next. However, in general, Washington County has comparable vulnerability to the Commonwealth based on similar concentrations of local, state, and federal facilities as other counties.

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 (Ganim, 2011). Sites previously 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.

4.3.11. Dam Failure

Due to data sensitivity, the Dam Failure profile can be found in Appendix H.

4.3.12. Environmental Hazards: Conventional Oil and Gas Wells

4.3.12.1. Location and Extent

One of the dominant industries in Washington County is extraction, both coal mining and conventional and unconventional oil and gas well drilling. Coal mining has occurred in Washington County since the 1700s, with conventional drilling and unconventional drilling becoming more prevalent in recent decades. Coal mining hazards are addressed in Section 4.3.7 Sinkhole and Subsidence, as they are mostly related to incidents of land failure in Washington County.

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. Between 300,000 and 760,000 oil and gas wells have been drilled in Pennsylvania since the first commercial oil well was developed in 1859. Additionally, oil and gas development has been taking place for nearly a century prior to permitting requirements enacted in1955, an estimated 100,00 to 560,000 abandoned wells are yet to be accounted for in the state (PA DEP, 2021d). 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 4.3.13.

There are approximately 7,337 conventional oil and gas wells drilled in Washington County (PA DEP, 2021e). Conventional wells are defined as traditional vertical wells. Well types are statuses countywide are as follows:

Well Types

- Oil Wells: 28%
- Gas Wells: 49%
- Combined Oil and Gas Wells: 4%
- Other Types of Conventional Wells: 12%
- Undetermined: 7%

Well Statuses

- Active: 27%
- Abandoned: 14%
- Orphaned: 1%
- Plugged: 47%
- Other Statuses: 12%

Other statuses include "proposed, but never materialized" meaning that a permit applicated was submitted but not approved, a well was entered erroneously into the database, or the permit was issued but the well was never drilled, and "operator reported not drilled," meaning the well permit has expired without being drilled or that the operator will not seek to drill.

There are active and abandoned oil and gas wells in 57 of 66 municipalities in Washington County with activity concentrated in the eastern portion of the county as shown in Figure

4.3.12-1. Data on conventional oil and gas wells obtained from PA DEP, provided in Table 4.3.12-1 below, shows that over Buffalo Township and East Finley Township have the largest number of conventional oil and gas wells, with 686 and 426 wells respectively.

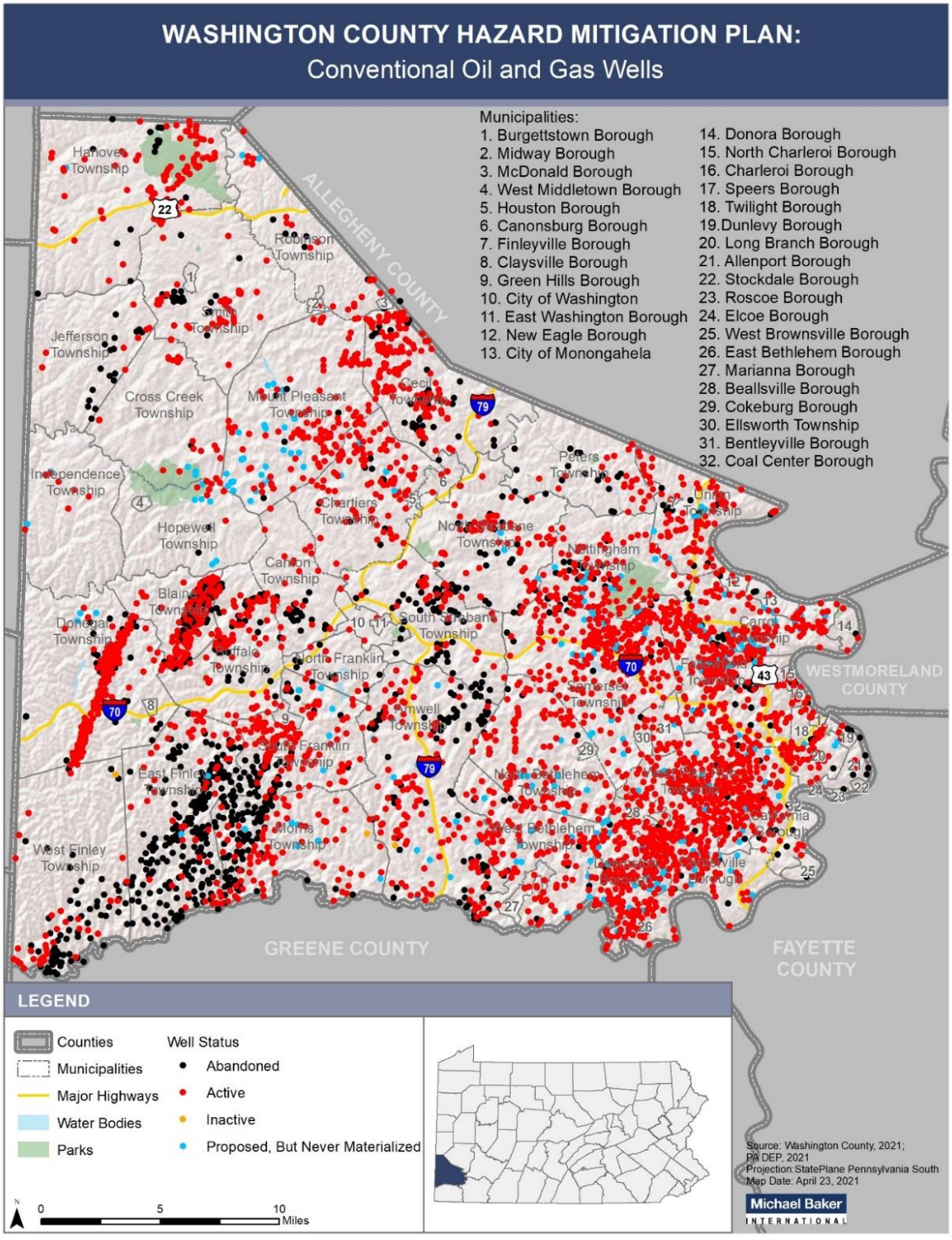
Private water supplies such as domestic water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants including methane which can pose a fire hazard. Private drinking water is largely unregulated and therefore the existing date is largely incomplete and/or inaccurate. Some information is submitted to the Pennsylvania Topographic and Geological Survey by water well drillers vis the PaGWIS system, but this data is voluntarily reported.

Table 4.3.12-1 Conventional Oil and Gas Wells in Washington County Municipalities (PA DEP, 2021e)

MUNICIPALITY	NUMBER OF WELLS	MUNICIPALITY	NUMBER OF WELLS
Allenport Borough	12	Houston Borough	10
Amwell Township	263	Independence Township	27
Beallsville Borough	37	Jefferson Township	42
Bentleyville Borough	24	Long Branch Borough	31
Blaine Township	312	Marianna Borough	1
Buffalo Township	686	McDonald Borough	2
Burgettstown Borough	0	Midway Borough	0
California Borough	115	Monongahela City	10
Canonsburg Borough	5	Morris Township	350
Canton Township	315	Mount Pleasant Township	166
Carroll Township	154	New Eagle Borough	3
Cecil Township	330	North Bethlehem Township	117
Centerville Borough	156	North Charleroi Borough	2
Charleroi Borough	12	North Franklin Township	144
Chartiers Township	222	North Strabane Township	250
Claysville Borough	0	Nottingham Township	127
Coal Center Borough	0	Peters Township	52
Cokeburg Borough	0	Robinson Township	40
Cross Creek Township	35	Roscoe Borough	1
Deemston Borough	168	Smith Township	138
Donegal Township	240	Somerset Township	248
Donora Borough	6	South Franklin Township	377
Dunlevy Borough	3	South Strabane Township	357
East Bethlehem Township	63	Speers Borough	8
East Finley Township	426	Stockdale Borough	0
East Washington Borough	25	Twilight Borough	17
Elco Borough	0	Union Township	106
Ellsworth Borough	1	Washington City	52
Fallowfield Township	302	West Bethlehem Township	143
Finleyville Borough	0	West Brownsville Borough	1

Table 4.3.12-1 Conventional Oil and Gas Wells in Washington County Municipalities (PA DEP, 2021e)			
MUNICIPALITY	NUMBER OF WELLS	MUNICIPALITY	NUMBER OF WELLS
Green Hills Borough	22	West Finley Township	127
Hanover Township	130	West Middletown Borough	0
Hopewell Township	99	West Pike Run Township	225
		TOTAL	7,337

Figure 4.3.12-1 Conventional Oil & Gas Well Locations in Washington County



4.3.12.2. 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.

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.

Common accidents involving gas well sites include "blowouts," which are an explosion or failure of the rig. 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.

4.3.12.3. Past Occurrence

Pennsylvania has a long history of oil and gas well drilling and though infrequent, many accidents and incidents have occurred related to the extraction of these natural resources. While no comprehensive list of oil and gas related incidents exists for the area, the PA DEP has made oil and gas well compliance information available to the public. Since January 1, 2000, there have been 1,339 environmental health and safety violations at oil and gas wells in Washington County. Of these violations, 555 were conventional well violations. These violations range in severity, from failure to implement protective plans like erosion and sedimentation control plans and encroachment plans to more serious infractions like discharging pollutant materials into the waters of the Commonwealth.

4.3.12.4. 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 the Department of Environment Protection (DEP) will reduce the likelihood of potential impacts to the community and the environment. Risk associated with conventional oil and gas drilling is expected to remain moderate though.

Table 4.3.12-2 Number of Conventional Well Permits in Washington County by Municipality 2015–2021 (PA DEP)	
MUNICIPALITY	NUMBER OF CONVENTIONAL PERMITS ISSUED
Amwell Township	0
Blaine Township	1
Buffalo Township	0
Canton Township	0
Carroll Township	0
Cecil Township	0
Chartiers Township	0
Cross Creek Township	8
Deemston Borough	0
Donegal Township	4
East Bethlehem Township	0
East Finley Township	0
Fallowfield Township	0
Hanover Township	0
Hopewell Township	0
Independence Township	0
Jefferson Township	2
Morris Township	0
Mount Pleasant Township	0
North Bethlehem Township	0
North Strabane Township	0
Nottingham Township	1
Robinson Township	0
Smith Township	3
Somerset Township	0
South Franklin Township	0
South Strabane Township	0
Union Township	0
West Bethlehem Township	0
West Finley Township	0
West Pike Run Township	0
TOTAL	19

The number of permits issued for oil and gas wells decreases each year, though production continues to increase. Between 2015 and 2020, only 19 permits were issued in Washington County for conventional wells. These were located in Blaine Township (1), Cross Creek

Township (8), Donegal Township (4), Jefferson Township (2), Nottingham Township (1), and Smith Township (3) (PA DEP, 2021d).

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 emissions from the thousands of orphaned and abandoned wells in Pennsylvania and determine how to quantify threats from abandoned wells (PA DEP, 2019b).

Based on the short history of past occurrence, the probability of future conventional and oil gas well events in considered *likely* according to the Risk Factor Methodology (see Section 4.4.1-1).

4.3.12.5. Vulnerability Assessment

Table 4.3.12-2 lists the population in each municipality vulnerable to conventional well incidents. 40 of 66 municipalities have over 80% population vulnerability. Over 73% of the county population is vulnerable to conventional well incidents.

Table 4.3.12-4 shows the structures and critical facilities that are vulnerable to conventional wells incidents. There are 74% of critical facilities within a close proximity to a conventional well. A complete listing of critical facilities is in Appendix E.

Structures and critical facilities within 1,000 yards of conventional wells are considered vulnerable. There are 72,076 structures in close proximity to conventional wells county-wide (74% of all structures). Twenty-four municipalities have 100% of their structures in close proximity to at least one conventional well and all but four municipalities are in close proximity to at least one conventional well. When looking at structures by property type, shown in Table 4.3.12-5, the majority of vulnerable structures are unsurprisingly residential in nature, followed by commercial uses.

Table 4.3.12-3 Populations Vulnerable to Conventional Oil and Gas Drilling Incidents

MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL	PERCENT POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL
Allenport Borough	556	525	94%
Amwell Township	3,782	3,449	91%
Beallsville Borough	510	494	97%
Bentleyville Borough	2,418	2,408	100%
Blaine Township	690	636	92%
Buffalo Township	2,010	1,778	88%
Burgettstown Borough	1,249	200	16%

Table 4.3.12-3 Populations Vulnerable to Conventional Oil and Gas Drilling Incidents			
MUNICIPALITY	**TOTAL 2010 POPULATION**	**2010 POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL**	**PERCENT POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL**
California Borough	6,785	2,652	39%
Canonsburg Borough	8,890	7,630	86%
Canton Township	8,429	6,047	72%
Carroll Township	5,508	5,367	97%
Cecil Township	11,270	8,455	75%
Centerville Borough	3,312	2,701	82%
Charleroi Borough	4,104	4,104	100%
Chartiers Township	7,958	6,562	82%
Claysville Borough	803	396	49%
Coal Center Borough	139	139	100%
Cokeburg Borough	667	309	46%
Cross Creek Township	1,511	422	28%
Deemston Borough	665	665	100%
Donegal Township	2,491	1,267	51%
Donora Borough	4,907	3,718	76%
Dunlevy Borough	386	386	100%
East Bethlehem Township	2,354	2,260	96%
East Finley Township	1,389	1,305	94%
East Washington Borough	1,943	1,763	91%
Elco Borough	261	6	2%
Ellsworth Borough	1,027	1,023	100%
Fallowfield Township	4,480	4,357	97%
Finleyville Borough	420	417	99%
Green Hills Borough	29	28	97%
Hanover Township	2,637	1,419	54%
Hopewell Township	923	343	37%
Houston Borough	1,237	1,151	93%
Independence Township	1,589	315	20%
Jefferson Township	1,231	458	37%
Long Branch Borough	482	478	99%
Marianna Borough	490	483	99%
McDonald Borough	1,752	1,747	100%
Midway Borough	917	865	94%
Monongahela, City of	4,297	4,217	98%
Morris Township	1,112	1,021	92%
Mount Pleasant Township	3,526	2,758	78%

Table 4.3.12-3 Populations Vulnerable to Conventional Oil and Gas Drilling Incidents			
MUNICIPALITY	**TOTAL 2010 POPULATION**	**2010 POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL**	**PERCENT POPULATION WITHIN 1,000 YARDS OF CONVENTIONAL OIL/GAS WELL**
New Eagle Borough	2,189	2,187	100%
North Bethlehem Township	1,594	1,353	85%
North Charleroi Borough	1,305	1,305	100%
North Franklin Township	4,569	3,357	73%
North Strabane Township	13,451	7,538	56%
Nottingham Township	3,030	1,674	55%
Peters Township	21,161	12,099	57%
Robinson Township	1,921	1,224	64%
Roscoe Borough	822	769	94%
Smith Township	4,603	2,285	50%
Somerset Township	2,748	2,657	97%
South Franklin Township	3,297	3,145	95%
South Strabane Township	9,337	7,454	80%
Speers Borough	1,154	1,149	100%
Stockdale Borough	493	266	54%
Twilight Borough	244	244	100%
Union Township	5,733	4,837	84%
Washington, City of	13,980	8,363	60%
West Bethlehem Township	1,449	1,370	95%
West Brownsville Borough	982	648	66%
West Finley Township	878	437	50%
West Middletown Borough	139	0	0%
West Pike Run Township	1,558	1,541	99%
TOTAL	**207,773**	**152,626**	**73.5%**

Table 4.3.12-4 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL
Allenport Borough	259	253	98%	8	8	100%
Amwell Township	1,683	1,553	92%	61	53	87%
Beallsville Borough	226	226	100%	9	9	100%
Bentleyville Borough	1,118	1,115	100%	13	13	100%
Blaine Township	278	262	94%	10	10	100%
Buffalo Township	863	754	87%	16	14	88%
Burgettstown Borough	643	131	20%	4	0	0%
California Borough	1,875	765	41%	27	17	63%
Canonsburg Borough	4,067	3,411	84%	23	21	91%
Canton Township	3,874	2,807	72%	44	22	50%
Carroll Township	2,547	2,469	97%	46	44	96%
Cecil Township	6,445	4,790	74%	66	40	61%
Centerville Borough	1,733	1,374	79%	19	17	89%
Charleroi Borough	2,046	2,046	100%	21	21	100%
Chartiers Township	4,155	3,450	83%	66	42	64%
Claysville Borough	330	162	49%	4	4	100%
Coal Center Borough	83	83	100%	1	1	100%
Cokeburg Borough	368	164	45%	4	1	25%
Cross Creek Township	770	237	31%	27	4	15%
Deemston Borough	365	365	100%	14	14	100%
Donegal Township	1,246	634	51%	36	17	47%
Donora Borough	2,413	1,780	74%	24	17	71%
Dunlevy Borough	205	205	100%	8	8	100%
East Bethlehem Township	1,199	1,160	97%	42	41	98%
East Finley Township	623	588	94%	17	16	94%
East Washington Borough	645	607	94%	1	1	100%

Table 4.3.12-4 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL
Elco Borough	146	15	10%	3	0	0%
Ellsworth Borough	461	460	100%	7	6	86%
Fallowfield Township	2,116	2,062	97%	65	63	97%
Finleyville Borough	214	214	100%	4	4	100%
Green Hills Borough	6	6	100%	4	4	100%
Hanover Township	1,253	688	55%	30	14	47%
Hopewell Township	448	160	36%	8	5	63%
Houston Borough	565	524	93%	3	2	67%
Independence Township	737	153	21%	17	5	29%
Jefferson Township	543	208	38%	17	0	0%
Long Branch Borough	232	231	100%	4	4	100%
Marianna Borough	262	261	100%	12	12	100%
McDonald Borough	954	954	100%	7	7	100%
Midway Borough	417	396	95%	1	1	100%
Monongahela, City of	2,065	2,023	98%	23	21	91%
Morris Township	467	433	93%	13	12	92%
Mount Pleasant Township	1,705	1,315	77%	51	39	76%
New Eagle Borough	1,033	1,033	100%	21	21	100%
North Bethlehem Township	779	669	86%	22	18	82%
North Charleroi Borough	578	578	100%	4	4	100%
North Franklin Township	2,023	1,560	77%	42	36	86%
North Strabane Township	7,373	4,353	59%	76	45	59%
Nottingham Township	1,329	810	61%	16	16	100%
Peters Township	9,029	5,121	57%	78	51	65%
Robinson Township	907	566	62%	34	17	50%

Table 4.3.12-4 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF A CONVENTIONAL WELL
Roscoe Borough	392	367	94%	5	5	100%
Smith Township	2,125	1,029	48%	51	25	49%
Somerset Township	1,251	1,214	97%	78	77	99%
South Franklin Township	1,313	1,263	96%	19	18	95%
South Strabane Township	4,266	3,338	78%	50	40	80%
Speers Borough	602	602	100%	13	13	100%
Stockdale Borough	250	147	59%	5	3	60%
Twilight Borough	108	108	100%	2	2	100%
Union Township	2,861	2,422	85%	52	49	94%
Washington, City of	5,433	3,324	61%	47	34	72%
West Bethlehem Township	708	672	95%	32	32	100%
West Brownsville Borough	525	359	68%	5	3	60%
West Finley Township	435	215	49%	24	19	79%
West Middletown Borough	78	0	0%	3	0	0%
West Pike Run Township	833	832	100%	16	16	100%
TOTAL	**96,881**	**72,076**	**74%**	**1,575**	**1,198**	**76%**

Table 4.3.12-5 Structures Vulnerable to Conventional Wells by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	1	1	1	2	3	244	1	0	253
Amwell Township	122	17	23	0	16	1,351	24	0	1,553
Beallsville Borough	7	14	0	0	2	203	0	0	226
Bentleyville Borough	8	132	1	0	9	964	1	0	1,115
Blaine Township	26	0	0	0	1	232	3	0	262
Buffalo Township	47	21	8	0	5	664	9	0	754
Burgettstown Borough	0	5	0	0	0	126	0	0	131
California Borough	12	19	5	3	16	606	104	0	765
Canonsburg Borough	0	279	13	24	16	3,079	0	0	3,411
Canton Township	42	111	17	10	13	2,610	4	0	2,807
Carroll Township	17	38	11	6	20	2,268	109	0	2,469
Cecil Township	395	89	213	16	283	3,785	7	1	4,790
Centerville Borough	23	29	5	2	11	1,254	49	1	1,374
Charleroi Borough	0	381	1	7	10	1,645	1	1	2,046
Chartiers Township	166	19	198	37	24	2,987	18	1	3,450
Claysville Borough	0	31	2	0	2	127	0	0	162
Coal Center Borough	0	0	3	0	0	80	0	0	83
Cokeburg Borough	0	0	1	0	0	163	0	0	164
Cross Creek Township	28	0	6	0	16	179	8	0	237
Deemston Borough	30	0	12	0	4	315	4	0	365
Donegal Township	62	12	5	5	12	528	9	1	634
Donora Borough	0	142	3	13	4	1,618	0	0	1,780
Dunlevy Borough	0	9	1	0	1	194	0	0	205
East Bethlehem Township	3	41	8	2	13	1,090	0	1	1,160
East Finley Township	103	2	15	0	7	452	9	0	588
East Washington Borough	0	3	0	0	12	592	0	0	607
Elco Borough	0	0	1	1	0	13	0	0	15

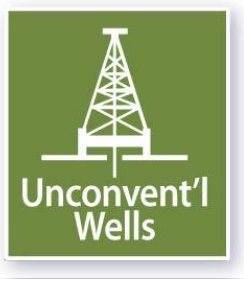
Table 4.3.12-5 Structures Vulnerable to Conventional Wells by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Ellsworth Borough	0	8	1	0	2	449	0	0	460
Fallowfield Township	25	24	9	4	22	1,877	101	0	2,062
Finleyville Borough	0	83	0	0	0	131	0	0	214
Green Hills Borough	1	0	0	0	2	3	0	0	6
Hanover Township	16	30	16	0	25	593	3	0	688
Hopewell Township	24	0	8	0	0	120	7	1	160
Houston Borough	0	64	0	0	1	459	0	0	524
Independence Township	9	0	2	0	2	133	6	1	153
Jefferson Township	22	0	4	0	1	178	3	0	208
Long Branch Borough	5	0	0	0	2	223	1	0	231
Marianna Borough	1	4	0	1	0	254	0	1	261
McDonald Borough	0	194	0	0	10	563	0	0	954
Midway Borough	0	4	0	0	1	391	0	0	396
Monongahela, City of	0	370	2	7	8	1,635	1	0	2,023
Morris Township	67	3	13	0	4	329	15	0	433
Mount Pleasant Township	148	37	19	0	14	1,082	15	0	1,315
New Eagle Borough	0	122	0	13	2	896	0	0	1,033
North Bethlehem Township	58	14	10	2	3	574	8	0	669
North Charleroi Borough	0	7	0	1	0	570	0	0	578
North Franklin Township	12	103	21	2	8	1,412	1	1	1,560
North Strabane Township	174	150	251	11	139	3,619	9	0	4,353
Nottingham Township	36	8	23	0	16	724	3	0	810
Peters Township	49	311	77	0	43	4,638	2	1	5,121
Robinson Township	8	5	3	3	10	524	6	0	566
Roscoe Borough	0	10	0	1	0	355	0	1	367
Smith Township	26	30	8	7	9	944	5	0	1,029

Table 4.3.12-5 Structures Vulnerable to Conventional Wells by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Somerset Township	70	50	17	1	21	1,042	13	0	1,214
South Franklin Township	28	7	4	0	8	1,192	24	0	1,263
South Strabane Township	77	253	31	99	9	2,865	4	0	3,338
Speers Borough	0	42	0	20	0	540	0	0	602
Stockdale Borough	0	0	0	0	1	146	0	0	147
Twilight Borough	1	4	1	1	2	99	0	0	108
Union Township	22	28	18	6	31	2,219	95	0	2,422
Washington, City of	0	575	3	19	44	2,681	2	0	3,324
West Bethlehem Township	51	14	6	1	8	583	9	0	672
West Brownsville Borough	0	23	1	0	2	333	0	0	359
West Finley Township	30	12	5	0	2	159	6	1	215
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	61	18	8	0	4	731	9	1	832
TOTAL	2,113	4,002	1,114	327	956	46,643	708	14	72,076

4.3.13. Environmental Hazards: Unconventional Oil and Gas Wells



4.3.13.1. 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-pressure 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.

In recent years, the advancement in drilling technology and capability has allowed for natural gas extraction from the Marcellus Shale formation which exists at a depth of 5,000 to 8,000 feet (PA DEP, 2020). Marcellus Shale natural gas extraction presents new and unique challenges and hazards in the Commonwealth. The Marcellus Shale and the Utica Shale formations are located underneath all of Washington County, which has led to an explosion of natural gas well drilling in the County, in addition to the traditional drilling. Activities associated with Marcellus Shale gas drilling can cause fire and pollute streams and drinking water. Additional hazards from oil and gas well drilling or particular concern to Washington County exist in stray methane gas in the subsurface, which can migrate to wells and homes and ignite.

The majority of unconventional wells in Washington County are oil wells (99%). There are only 34 combined oil and gas wells and zero oil wells (PA DEP, 2021e). There are 3,095 unconventional oil and gas wells in Washington County. This includes:

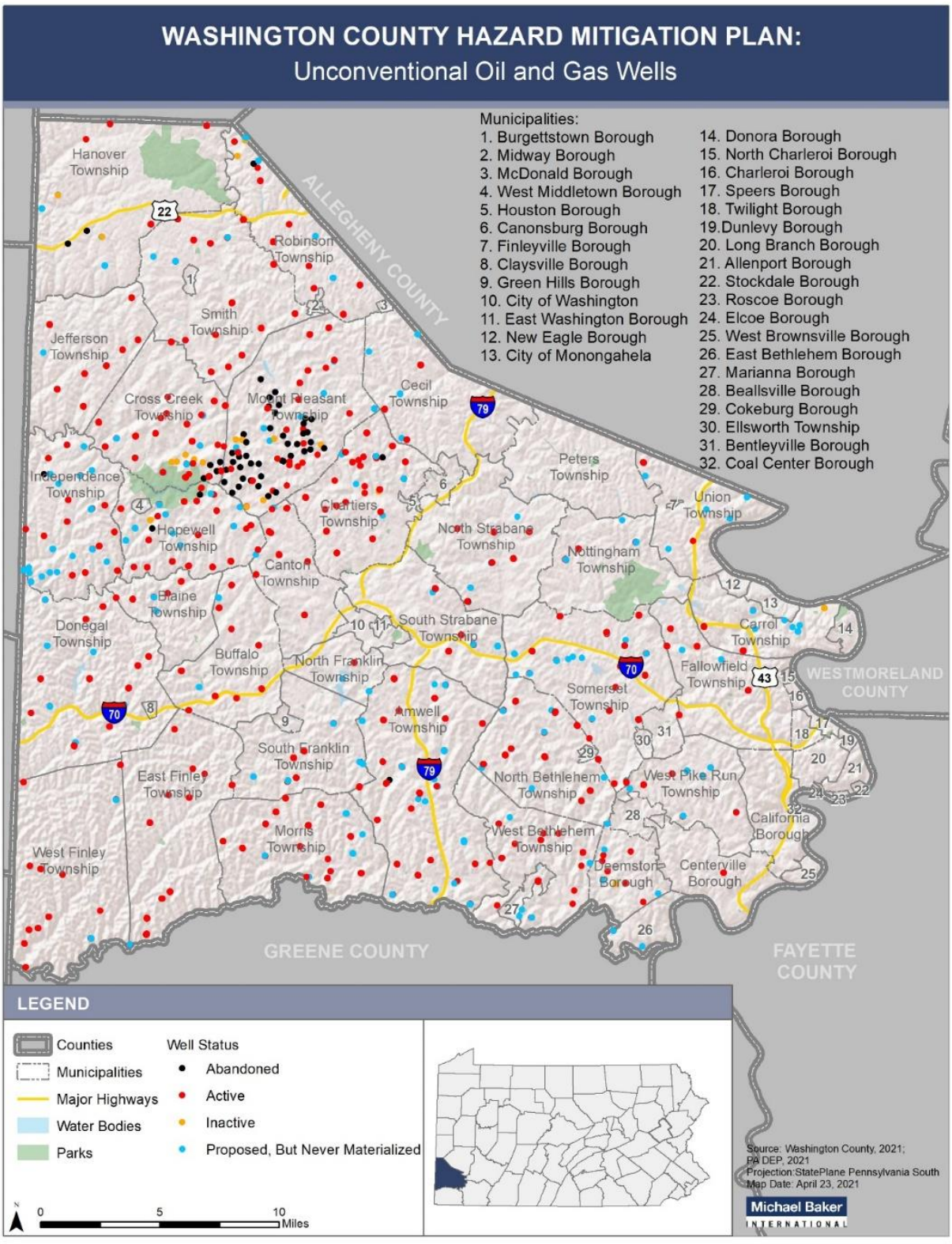
- 1,998 Active wells (65%)
- 25 Regulatory inactive status (1%)
- 95 Plugged wells (3%)
- 411 Proposed but never materialized (13%)
- 566 Operator reported not drilled (18%)

Table 4.3.13-1 lists the number of unconventional oil and gas wells in each municipality. As shown in Figure 4.3.13-1 unconventional wells are scattered throughout 33 of 66 municipalities in Washington County. The highest number of unconventional wells are in Amwell Township (364) and Somerset Township (194). Since the 2010 County HMP, the number of oil and gas wells in Washington County has grown exponentially.

Table 4.3.13-1 Unconventional Oil and Gas Wells in Washington County Municipalities (PA DEP, 2021e)

MUNICIPALITY	NUMBER OF WELLS	MUNICIPALITY	NUMBER OF WELLS
Allenport Borough	0	Houston Borough	0
Amwell Township	364	Independence Township	133
Beallsville Borough	0	Jefferson Township	67
Bentleyville Borough	0	Long Branch Borough	0
Blaine Township	39	Marianna Borough	0
Buffalo Township	99	McDonald Borough	0
Burgettstown Borough	0	Midway Borough	0
California Borough	0	Monongahela City	0
Canonsburg Borough	0	Morris Township	137
Canton Township	39	Mount Pleasant Township	150
Carroll Township	82	New Eagle Borough	0
Cecil Township	36	North Bethlehem Township	149
Centerville Borough	5	North Charleroi Borough	0
Charleroi Borough	0	North Franklin Township	19
Chartiers Township	116	North Strabane Township	89
Claysville Borough	0	Nottingham Township	63
Coal Center Borough	0	Peters Township	0
Cokeburg Borough	0	Robinson Township	107
Cross Creek Township	167	Roscoe Borough	0
Deemston Borough	15	Smith Township	108
Donegal Township	123	Somerset Township	194
Donora Borough	0	South Franklin Township	46
Dunlevy Borough	0	South Strabane Township	51
East Bethlehem Township	7	Speers Borough	0
East Finley Township	148	Stockdale Borough	0
East Washington Borough	0	Twilight Borough	0
Elco Borough	0	Union Township	30
Ellsworth Borough	0	Washington City	0
Fallowfield Township	43	West Bethlehem Township	88
Finleyville Borough	0	West Brownsville Borough	0
Green Hills Borough	0	West Finley Township	97
Hanover Township	65	West Middletown Borough	0
Hopewell Township	162	West Pike Run Township	57
		TOTAL	3,095

Figure 4.3.13-1 Unconventional Oil & Gas Well Locations in Washington County



4.3.13.2. Range of Magnitude

Horizontal drilling associated with unconventional oil and gas wells 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 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 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.

Marcellus gas well drilling can have a variety of effects on the environment. For example, some areas have experienced stray methane gas in the subsurface; under certain conditions, this methane can migrate to private water supply wells and ultimately into a house or structure. Unmitigated methane can build to explosive concentrations. A proper well vent allows methane to vent to the atmosphere rather than build up to explosive levels. The risk of an explosion from stray methane varies from location to location based on site-specific conditions.

Surface waters and soil are sometimes polluted by brine, a salty wastewater product of gas well drilling, and from 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.

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

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

- 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;

With a natural gas release, whether accidental or intentional, there are several potentially exacerbating or mitigating circumstances that will affect its severity or impact. Exacerbating conditions are characteristics that can enhance or magnify the effects of a hazard. Mitigating conditions, on the other hand, are characteristics of the target and its physical environment that can reduce the effects of a hazard. These conditions include the following:

- Weather conditions: affects how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain: alters dispersion of hazardous materials
- Shielding in the form of sheltering-in-place: protects people and property from harmful effects
- Non-compliance with applicable codes (i.e. building or fire codes) and maintenance failures (i.e. fire protection and containment features): can substantially increase the damage to the facility itself and to surrounding buildings

The severity of the incident varies with concentration of natural gas 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 a release can travel great distances, resulting in far-reaching effects on people and the environment.

Impacts of incidents at natural gas drilling sites can vary from relatively minor to catastrophic. If a large volume of natural gas escapes from a well at the surface, it will expand and spread over a large area. The potential for a major explosion of the gas exists; this explosion could kill hundreds of people, destroy property, spark wildland and urban fires, overwhelm the local EMS services and hospitals with the influx of casualties, force evacuations, close roads, cause utility outages (if a power or telephone transmission line is damaged), etc.

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 Washington County. This is particularly and issue in the northwestern portion of the County, where residents rely on domestic water wells for their potable water supply.

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. 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 (PA DEP, 2010). Beyond the purely environmental impacts of drilling, Washington County is likely to be see significant indirect effects on its transportation infrastructure and land cover. These indirect effects are explored in Section 4.3.12.4 as they are likely to impact Washington County as a whole and over the long-term, rather than in the case of a specific incident.

4.3.13.3. Past Occurrence

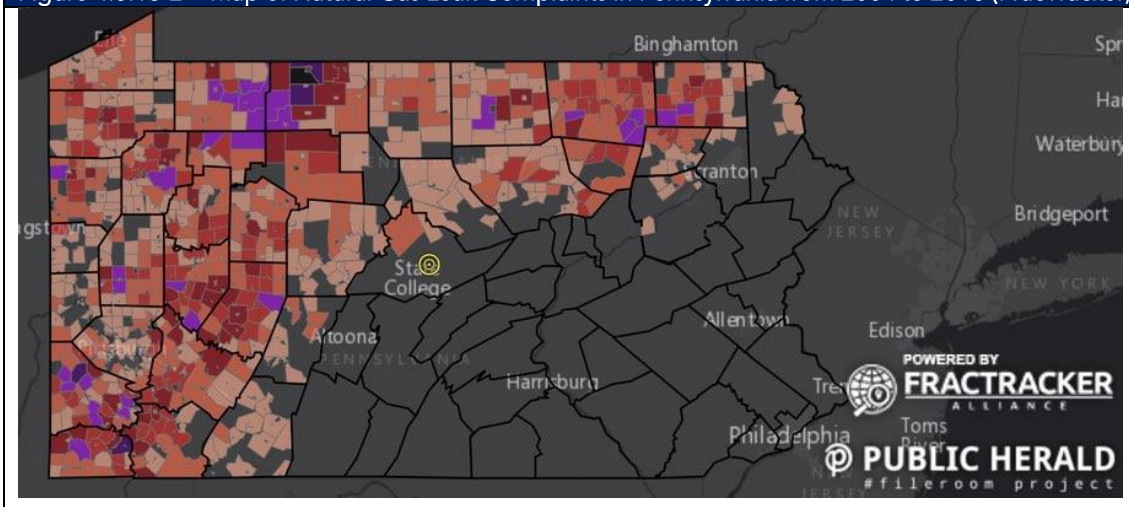
Pennsylvania has a long history of oil and gas well drilling and though infrequent, many accidents and incidents have occurred related to the extraction of these natural resources.

While no comprehensive list of oil and gas related incidents exists for the area, the PA DEP has made oil and gas well compliance information available to the public. Since January 1, 2000, there have been 1,339 environmental health and safety violations at oil and gas wells in Washington County. Of these violations, 784 occurred at unconventional wells. These violations range in severity, from failure to implement protective plans like erosion and sedimentation control plans and encroachment plans to more serious infractions like discharging pollutant materials into the waters of the Commonwealth. The most common infractions were:

1. Failure to minimize accelerated erosion, implement Erosion & Sedimentation (E&S) plan, maintain E&S controls, and failure to stabilize site until total site restoration (88 violations).
2. Failure to properly control or dispose of industrial or residual waste to prevent water pollution (69 violations).

Between January 2004 and November 2016, PA DEP logged 973 total complaints across the Commonwealth, with 162 specific to water (FracTracker, 2021). A map developed by Public Herald and FracTracker Alliance shows the distribution of complaints with highest densities in the center and southeast of the County (2017) (see Figure 4.3.13-2).

Figure 4.3.13-2 Map of Natural Gas Leak Complaints in Pennsylvania from 2004 to 2016 (FracTracker, 2017)



4.3.13.4. Future Occurrence

The likelihood of an emergency at a natural gas drilling site in Washington County cannot be determined at this time, as there is little historical data to analyze. However, the likelihood of an incident within the County is expected to increase with the dramatic increase in the number of well sites. Future emergencies will occur at well sites as well as along the natural gas transportation network. As more permits are issued, this traffic will increase further. Also, the County will face an increased risk of pipeline emergencies as the related infrastructure is put in place.

Table 4.3.13-2 Number of Well Permits Issued per Year From 2010-2021 (PA DEP, 2021e)	
YEAR	NUMBER OF PERMITS ISSUED
2010	224
2012	306
2013	297
2014	414
2015	369
2016	330
2017	516
2018	319
2019	261
2020	177
2021	36*
TOTAL	3,249

*2021 data through May of 2021.

In just five years, between 2015 and 2020, 1,972 permits for natural gas drilling in unconventional wells were issued. Table 4.3.13-2 lists the number of permits issued in Washington County per year between 2010 and May 2021. Table 4.3.13-3 lists the number of permits for unconventional oil and gas wells issued between 2015 and 2021 by municipality.

Table 4.3.13-2 shows a breakdown of unconventional permits issued per year, and Table 4.3.13-3 shows the number of (conventional and unconventional) permits per municipality. The industry is highly regulated by the Pennsylvania DEP, and local response agencies have been trained to deal with accidents at the sites, but the threat of releases, fire, and explosions remains.

Table 4.3.13-3 Number of Unconventional Well Permits Issued in Washington County by Municipality 2015–2021 (PA DEP, 2021e)			
MUNICIPALITY	NUMBER OF PERMITS ISSUED	MUNICIPALITY	NUMBER OF PERMITS ISSUED
Amwell Township	275	Jefferson Township	53
Blaine Township	42	Morris Township	56
Buffalo Township	82	Mount Pleasant Township	17
Canton Township	8	North Bethlehem Township	138
Carroll Township	82	North Strabane Township	90
Cecil Township	19	Nottingham Township	74
Chartiers Township	28	Robinson Township	78
Cross Creek Township	30	Smith Township	77
Deemston Borough	9	Somerset Township	169
Donegal Township	66	South Franklin Township	4
East Bethlehem Township	5	South Strabane Township	73
East Finley Township	165	Union Township	16
Fallowfield Township	59	West Bethlehem Township	63
Hanover Township	47	West Finley Township	57
Hopewell Township	19	West Pike Run Township	38
Independence Township	32	TOTAL	1,972

Note: Municipalities with no permits issued within the time period were omitted from the table.

The unconventional well drilling in Washington County not only implies the increased risk of an incident (that can include a chemical release, a fire, and/or an explosion) as well as the likelihood of a spill and ground (or surface) water contamination, but also increased development and deforestation, both which result in significantly more stress on the existing (transportation) infrastructure and impervious surface. The implications of the increased use of the transportation infrastructure are rather straightforward. The natural gas drilling process requires 2,300 to 4,000 truck trips per well (Cassidy, 2014), so that not only are there more trucks on the roads, but they are using roads often designed for heavy use. Increased use of the roads by heavy trucks can significantly increase the wear-and-tear on the roads (which were, in most cases, not designed for that type of traffic) and subsequently increase the likelihood of traffic incidents.

Careful consideration of which roads are actually suitable for heavy, industrial use and improved safety measures (including more traffic signals and officers, or a planned trucking schedule) could help reduce traffic incidents and infrastructure degradation (Cassidy, 2014). Additionally, the industry could take responsibility for improving maintenance of the infrastructure and scheduling of their traffic so as to keep heavy truck flow to certain hours and thereby minimize incidents.

Impervious surfaces can increase the risk of flooding (as rain or run-off can no longer readily seep into the ground) and can prove exceedingly detrimental to maintaining a balanced ecosystem. Estimates vary slightly (based on location, technology, etc.), but the average footprint of a well pad is 1.3 hectares and the associated infrastructure is 10.3 hectares (Evans and Kiesecker, 2014) (Environment America, 2013). If the indirect impact are considered as well, this then the total land disturbance, and impact on the permeability of the ground, is 20.2 hectares, or about 50 acres (Evans and Kiesecker, 2014). If this unit is applied to the number of new wells in the past five years in Washington County, then about 26,038 hectares (101 square miles), roughly 12% of the total area of the County, was disturbed by or converted to a fracking use.

If continued investment and development in the natural gas industry is inevitable, then the County should take measures to plan for future development to help mitigate the impacts of well drilling on transportation infrastructure and impervious surfaces. One major component of this is the regulation of new well pads siting locations. The design and process of a shale, horizontal well, is such that the placement of the well pad is much more flexible (as there are multiple lateral wells that extend to a greater area), and the siting has the ability to take impacts to natural habitats into account. In determining more ecologically appropriate locations that reduce potential runoff, the County could require a setback from streams and wetlands, as well as avoidance of development on areas with a steep slope. Additionally, greater care and oversight could be taken to balance future well development with watershed needs and conservation goals.

On the whole, the probability of future natural gas drilling incident events can be considered *likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.13.5. Vulnerability Assessment

Vulnerability to oil and gas well incidents is defined as being located within 1,000 yards of an unconventional oil or gas well. This buffer is what DEP uses as its "zone of culpability" for oil and gas well incidents. While explosions or other catastrophic incidents at an oil or gas well could cause property damage, of primary concern is the population living near these wells. Table 4.3.13-4 lists the municipal populations living within 1,000 yards of an unconventional oil and gas well. About 12% of the countywide population lives in areas vulnerable to unconventional oil and gas well incidents. The highest number of vulnerable populations are found in Mount Pleasant Township (2,204 people) and Chartiers Township (2,085 people). Four municipalities have over 70% of their populations vulnerable to unconventional oil and gas well incidents: Marianna Borough (91%), Cokeburg Borough (82%), Independence Township (80%), and Hopewell Township (72%).

Table 4.3.13-5 shows the structures and critical facilities that are vulnerable to unconventional wells incidents. There are 25% of critical facilities within a close proximity to an unconventional well. Hopewell Township is the one municipality that has 100% of their critical facilities. A complete listing of critical facilities is in Appendix E.

Structures and critical facilities within 1,000 yards of and unconventional wells are considered vulnerable. There are 12,102 structures in close proximity to unconventional wells county-wide (12% of all structures). Forty-two municipalities are in close proximity to at least one unconventional well. When looking at structures by property type, shown in Table 4.3.13-6, the majority of vulnerable structures are unsurprisingly residential in nature, followed by agricultural uses.

Table 4.3.13-4 Populations Vulnerable to Unconventional Oil and Gas Drilling Incidents

MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELLS*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
Allenport Borough	556	0	0%
Amwell Township	3,782	1,682	44%
Beallsville Borough	510	8	2%
Bentleyville Borough	2,418	104	4%
Blaine Township	690	127	18%
Buffalo Township	2,010	667	33%
Burgettstown Borough	1,249	0	0%
California Borough	6,785	0	0%
Canonsburg Borough	8,890	0	0%
Canton Township	8,429	712	8%
Carroll Township	5,508	926	17%

Table 4.3.13-4 Populations Vulnerable to Unconventional Oil and Gas Drilling Incidents			
MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELLS*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
Cecil Township	11,270	649	6%
Centerville Borough	3,312	186	6%
Charleroi Borough	4,104	0	0%
Chartiers Township	7,958	2,085	26%
Claysville Borough	803	0	0%
Coal Center Borough	139	0	0%
Cokeburg Borough	667	550	82%
Cross Creek Township	1,511	764	51%
Deemston Borough	665	358	54%
Donegal Township	2,491	638	26%
Donora Borough	4,907	0	0%
Dunlevy Borough	386	0	0%
East Bethlehem Township	2,354	164	7%
East Finley Township	1,389	329	24%
East Washington Borough	1,943	0	0%
Elco Borough	261	0	0%
Ellsworth Borough	1,027	83	8%
Fallowfield Township	4,480	709	16%
Finleyville Borough	420	0	0%
Green Hills Borough	29	0	0%
Hanover Township	2,637	355	13%
Hopewell Township	923	660	72%
Houston Borough	1,237	0	0%
Independence Township	1,589	1,269	80%
Jefferson Township	1,231	277	23%
Long Branch Borough	482	0	0%
Marianna Borough	490	447	91%
McDonald Borough	1,752	0	0%
Midway Borough	917	133	15%
Monongahela, City of	4,297	238	6%
Morris Township	1,112	480	43%
Mount Pleasant Township	3,526	2,204	63%
New Eagle Borough	2,189	0	0%
North Bethlehem Township	1,594	678	43%
North Charleroi Borough	1,305	0	0%
North Franklin Township	4,569	396	9%

Table 4.3.13-4 Populations Vulnerable to Unconventional Oil and Gas Drilling Incidents			
MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELLS*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
North Strabane Township	13,451	815	6%
Nottingham Township	3,030	327	11%
Peters Township	21,161	397	2%
Robinson Township	1,921	492	26%
Roscoe Borough	822	0	0%
Smith Township	4,603	517	11%
Somerset Township	2,748	1,053	38%
South Franklin Township	3,297	711	22%
South Strabane Township	9,337	243	3%
Speers Borough	1,154	0	0%
Stockdale Borough	493	0	0%
Twilight Borough	244	0	0%
Union Township	5,733	908	16%
Washington, City of	13,980	0	0%
West Bethlehem Township	1,449	454	31%
West Brownsville Borough	982	0	0%
West Finley Township	878	124	14%
West Middletown Borough	139	5	4%
West Pike Run Township	1,558	350	22%
TOTAL	**207,773**	**24,274**	**11.7%**

Table 4.3.13-5 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL
Allenport Borough	259	0	0%	8	0	0%
Amwell Township	1,683	763	45%	61	34	56%
Beallsville Borough	226	3	1%	9	1	11%
Bentleyville Borough	1,118	85	8%	13	4	31%
Blaine Township	278	41	15%	10	3	30%
Buffalo Township	863	295	34%	16	9	56%
Burgettstown Borough	643	0	0%	4	0	0%
California Borough	1,875	0	0%	27	0	0%
Canonsburg Borough	4,067	0	0%	23	0	0%
Canton Township	3,874	313	8%	44	4	9%
Carroll Township	2,547	448	18%	46	17	37%
Cecil Township	6,445	406	6%	66	7	11%
Centerville Borough	1,733	78	5%	19	1	5%
Charleroi Borough	2,046	0	0%	21	0	0%
Chartiers Township	4,155	1,231	30%	66	24	36%
Claysville Borough	330	0	0%	4	0	0%
Coal Center Borough	83	0	0%	1	0	0%
Cokeburg Borough	368	321	87%	4	2	50%
Cross Creek Township	770	401	52%	27	11	41%
Deemston Borough	365	183	50%	14	12	86%
Donegal Township	1,246	324	26%	36	7	19%
Donora Borough	2,413	0	0%	24	0	0%
Dunlevy Borough	205	0	0%	8	0	0%
East Bethlehem Township	1,199	77	6%	42	2	5%
East Finley Township	623	154	25%	17	6	35%

Table 4.3.13-5 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL
East Washington Borough	645	0	0%	1	0	0%
Elco Borough	146	0	0%	3	0	0%
Ellsworth Borough	461	37	8%	7	0	0%
Fallowfield Township	2,116	302	14%	65	20	31%
Finleyville Borough	214	0	0%	4	0	0%
Green Hills Borough	6	0	0%	4	0	0%
Hanover Township	1,253	163	13%	30	4	13%
Hopewell Township	448	324	72%	8	8	100%
Houston Borough	565	0	0%	3	0	0%
Independence Township	737	582	79%	17	15	88%
Jefferson Township	543	123	23%	17	0	0%
Long Branch Borough	232	0	0%	4	0	0%
Marianna Borough	262	234	89%	12	11	92%
McDonald Borough	954	0	0%	7	0	0%
Midway Borough	417	68	16%	1	0	0%
Monongahela, City of	2,065	121	6%	23	2	9%
Morris Township	467	215	46%	13	6	46%
Mount Pleasant Township	1,705	1,086	64%	51	39	76%
New Eagle Borough	1,033	0	0%	21	0	0%
North Bethlehem Township	779	338	43%	22	12	55%
North Charleroi Borough	578	0	0%	4	0	0%
North Franklin Township	2,023	173	9%	42	19	45%

Table 4.3.13-5 Structures and Critical Facilities Vulnerable to Conventional Wells in Washington County						
MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT STRUCTURES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL	PERCENT CRITICAL FACILITIES WITHIN 1,000 YDS OF AN UNCONVENTIONAL WELL
North Strabane Township	7,373	578	8%	76	17	22%
Nottingham Township	1,329	158	12%	16	5	31%
Peters Township	9,029	182	2%	78	1	1%
Robinson Township	907	242	27%	34	19	56%
Roscoe Borough	392	0	0%	5	0	0%
Smith Township	2,125	246	12%	51	12	24%
Somerset Township	1,251	487	39%	78	33	42%
South Franklin Township	1,313	261	20%	19	3	16%
South Strabane Township	4,266	109	3%	50	1	2%
Speers Borough	602	0	0%	13	0	0%
Stockdale Borough	250	0	0%	5	0	0%
Twilight Borough	108	0	0%	2	0	0%
Union Township	2,861	473	17%	52	12	23%
Washington, City of	5,433	0	0%	47	0	0%
West Bethlehem Township	708	218	31%	32	3	9%
West Brownsville Borough	525	0	0%	5	0	0%
West Finley Township	435	70	16%	24	10	42%
West Middletown Borough	78	4	5%	3	0	0%
West Pike Run Township	833	185	22%	16	5	31%
TOTAL	**96,881**	**12,102**	**12%**	**1,575**	**401**	**25%**

Table 4.3.13-6 Structures Vulnerable to Unconventional Wells by Land Use in Washington County

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	0	0	0	0	0	0	0	0	0
Amwell Township	67	10	16	0	3	644	23	0	763
Beallsville Borough	1	0	0	0	0	2	0	0	3
Bentleyville Borough	0	6	0	0	6	72	1	0	85
Blaine Township	6	0	2	0	0	30	3	0	41
Buffalo Township	23	10	4	0	2	246	10	0	295
Burgettstown Borough	0	0	0	0	0	0	0	0	0
California Borough	0	0	0	0	0	0	0	0	0
Canonsburg Borough	0	0	0	0	0	0	0	0	0
Canton Township	14	1	5	0	0	286	7	0	313
Carroll Township	9	9	4	3	4	383	36	0	448
Cecil Township	68	6	7	0	132	190	2	1	406
Centerville Borough	4	0	0	0	0	71	3	0	78
Charleroi Borough	0	0	0	0	0	0	0	0	0
Chartiers Township	105	7	124	6	7	962	18	2	1,231
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	0	0	0	0	0	0	0
Cokeburg Borough	0	2	1	0	0	318	0	0	321
Cross Creek Township	49	15	6	0	13	298	19	1	401
Deemston Borough	19	0	8	0	3	149	4	0	183
Donegal Township	44	2	2	0	9	254	12	1	324
Donora Borough	0	0	0	0	0	0	0	0	0
Dunlevy Borough	0	0	0	0	0	0	0	0	0
East Bethlehem Township	0	0	2	0	0	74	0	0	77
East Finley Township	25	0	9	0	2	106	9	0	154
East Washington Borough	0	0	0	0	0	0	0	0	0

Table 4.3.13-6 Structures Vulnerable to Unconventional Wells by Land Use in Washington County

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Elco Borough	0	0	0	0	0	0	0	0	0
Ellsworth Borough	0	0	0	0	0	37	0	0	37
Fallowfield Township	4	1	6	1	1	286	3	0	302
Finleyville Borough	0	0	0	0	0	0	0	0	0
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	4	9	8	0	9	132	1	0	163
Hopewell Township	72	0	15	0	8	210	18	1	324
Houston Borough	0	0	0	0	0	0	0	0	0
Independence Township	34	25	7	0	4	493	19	0	582
Jefferson Township	16	0	1	0	4	98	4	0	123
Long Branch Borough	0	0	0	0	0	0	0	0	0
Marianna Borough	1	2	0	1	0	229	0	1	234
McDonald Borough	0	0	0	0	0	0	0	0	0
Midway Borough	0	0	0	0	0	68	0	0	68
Monongahela, City of	0	1	0	0	1	119	0	0	121
Morris Township	32	2	6	0	3	156	15	0	215
Mount Pleasant Township	141	36	16	0	12	863	18	0	1,086
New Eagle Borough	0	0	0	0	0	0	0	0	0
North Bethlehem Township	32	9	5	1	2	280	9	0	338
North Charleroi Borough	0	0	0	0	0	0	0	0	0
North Franklin Township	1	1	0	0	2	167	1	1	173
North Strabane Township	27	20	100	1	55	369	6	0	578
Nottingham Township	7	0	1	0	0	148	2	0	158
Peters Township	0	1	1	0	2	178	0	0	182
Robinson Township	18	13	3	1	6	189	12	0	242
Roscoe Borough	0	0	0	0	0	0	0	0	0

Table 4.3.13-6 Structures Vulnerable to Unconventional Wells by Land Use in Washington County

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Smith Township	30	7	7	0	6	185	11	0	246
Somerset Township	42	20	8	0	13	392	12	0	487
South Franklin Township	6	0	3	0	0	247	5	0	261
South Strabane Township	17	1	3	0	1	85	2	0	109
Speers Borough	0	0	0	0	0	0	0	0	0
Stockdale Borough	0	0	0	0	0	0	0	0	0
Twilight Borough	0	0	0	0	0	0	0	0	0
Union Township	12	4	7	0	4	408	37	0	473
Washington, City of	0	0	0	0	0	0	0	0	0
West Bethlehem Township	30	0	5	0	2	174	7	0	218
West Brownsville Borough	0	0	0	0	0	0	0	0	0
West Finley Township	20	1	4	0	0	35	9	1	70
West Middletown Borough	0	0	0	0	1	3	0	0	4
West Pike Run Township	27	1	1	0	0	149	6	1	185
TOTAL	1,007	222	397	14	317	9,785	344	10	12,102

4.3.14. Opioid Addiction

4.3.14.1. 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 (US DEA, 2020). The Centers for Disease Control and Prevention (CDC) defines the following as the three most common types of opioids (CDC, 2021a):

- 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 (US DEA, 2016).

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 36 out of every 100,000 Pennsylvania residents died from opioid-related overdoses in 2019, 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 incidents (CDC, 2021b).

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 United Stated Environmental Protection Agency (EPA) suggests that while the risks of pharmaceuticals found in wastewater, ambient water, and drinking water is low, further research is needed (EPA, 2014).

4.3.14.2. 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, more than quadrupled from 1999 to 2014. In 2017, seven of 1,000 newborns were diagnosed with this condition across the US; approximately 80 newborns diagnosed every day. Pennsylvania had a rate of 14 newborns per 1,000 in 2017 (CDC, 2020).

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 (DEA Philadelphia Division, 2017).

A significant opioid related incident occurred in Luzerne County in 2018. The City of Hazleton experienced five opioid overdoses in 12 hours with two resulting in death on May 4, 2018. The Hazleton police chief warned citizens about a potentially deadly batch of heroin, possibly laced with fentanyl (Albert, 2018). A similar incident would be a worst-case scenario for Washington County.

4.3.14.3. Past Occurrence

The CDC found that opioids are the main cause of drug-related overdoses and deaths, being responsible for nearly seventy-five 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 (DEA Philadelphia Division, 2017).

In 2017, overdose death rates were concentrated in southwestern Pennsylvania Counties. However, in 2018, the highest opioid-related death rates were concentrated in eastern and central Pennsylvania. In 2018, Washington County experienced 34 opioid related overdose deaths per 100,000 people. The County was ranked 17th in the State for opioid related overdose deaths. This is down from its rank in 13th in 2017 with 47 deaths per 100,000 people. (DEA Philadelphia Division, 2019).

County sources document overdose related deaths in Washington County, listed in Table 4.3.12-1 below. Opioid related deaths have remained relatively constant over the past five years. In general, fentanyl related deaths have increased since 2015 while heroin related deaths have remained relatively the same.

Table 4.3.14-1 Opioid Related Deaths in Washington County (Washington County, 2019)

YEAR	OVERDOSE RELATED DEATHS		
	# OF HEROIN RELATED DEATHS	# OF FENTANYL RELATED DEATHS	TOTAL # OF DEATHS
2015	38	16	73
2016	47	68	109
2017	25	71	97
2018	33	58	76
2019	31	63	81

Washington County law enforcement and drug counselors note there has been a sharp increase in fatal overdoses, especially related to drugs laced with fentanyl. By March 2021, the coroner's office had identified 33 suspected overdoses. Iin March 2020 there were 20 suspected overdoses identified throughout the first three months of the year. This points to an increase in fentanyl laced drugs in the region which may lead to increased opioid related deaths (Guidotti, 2021).

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, 2021).

4.3.14.4. 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 2021.

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 the Pennsylvania Emergency Management Agency (PA DOH, 2018).

Washington Opioid Overdose Coalition works to increase prescription drug monitoring, increase access to naloxone, reduce stigma on drug addiction, and increase access to SUD treatment programs. Partners in the coalition include government agencies such as the Washington Drug and Alcohol Commission, Washington County Coroner's Office, Washington Department of Public Safety, Monongahela Valley Hospital, Washington Health System, the Drug Enforcement Administration, members of the faith based community, recovery community members, prevention specialists, treatment providers, and youth service workers (WOOC, 2021). Additional resources include Narcan requests, drug disposal sites, and education and information. It is possible that risk will reduce in the future depending on the outcome of this and future initiatives.

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

4.3.14.5. 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 Philadelphia Division, 2017).

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 Washington. 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 Washington County has had a total per capita cost of $372,929,102.

4.3.15. Transportation Incidents

4.3.15.1. Location and Extent

For this analysis a transportation incident is defined as an incident involving highway, air, or rail travel. This analysis includes the location of all public airports, passenger and freight rail lines, and highways where major incidents are likely to occur.

Within Washington County, there are over 2,800 miles of roads and 933 bridges (PennDOT, 2019a; PennDOT, 2021). A total of 148 of these bridges (15.9%) are classified as in poor condition by PennDOT. Key freight routes include I-70, I-79, US 22, and US 43. In 2019, PennDOT statistics indicated over 6 million daily vehicle miles traveled within Washington County. There are four rail lines in Washington County. They are Norfolk Southern Railway, which runs along the Monongahela River and to Marianna through Cokeburg; Wheeling & Lake Erie Railway, which runs across the northern portion of the County; CSXT, which runs from the City of Washington to Pittsburgh; and a local line haul from Arden to Pittsburgh (PennDOT, 2019b). There is a potential for major incidents on any of these roads, bridges or railways.

There are five airports within the jurisdiction of Washington 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 Washington County. Figure 4.3.15-1 illustrates the major transportation systems in the County while Figure 4.3.15.2 shows the traffic volume on key roadways.

Figure 4.3.15-1 Transportation Systems in Washington County

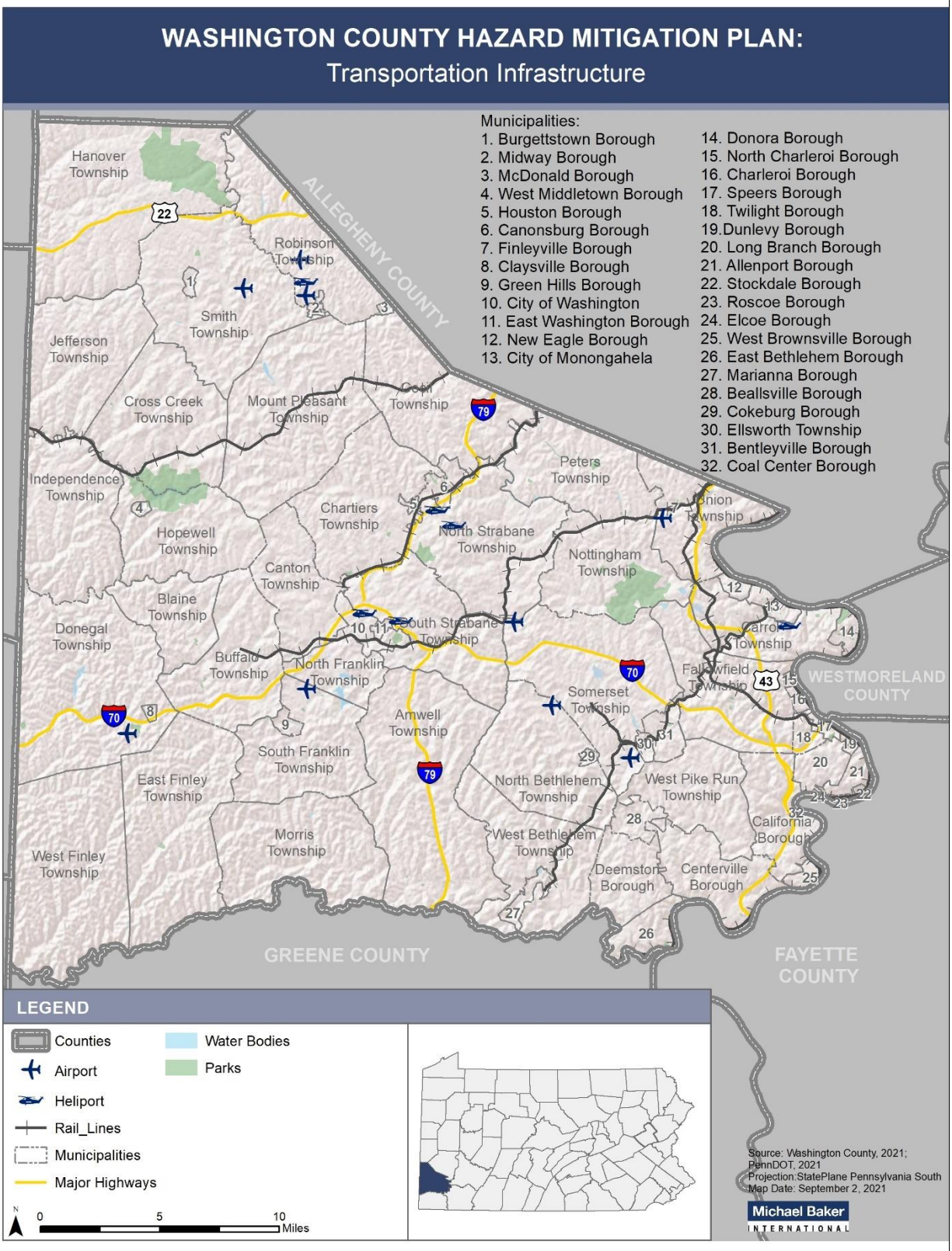


Figure 4.3.15-2 Traffic Volume in Washington County

4.3.15.2. Range of Magnitude

At a minimum, transportation incidents can result in damage to the vehicles and minor injuries to passengers and drivers. At worst, significant transportation incidents can result in death or serious injury or extensive property loss or damage coupled with business interruptions and hours of congestion. Road and railway incidents in particular have the potential to result in hazardous materials releases if the vehicle involved in an incident is hauling hazardous materials. The expected impacts of transportation incidents are amplified by the fact that there is often little warning of incidents.

The worst-case scenario for a transportation incident impacting Washington County would be a road incident which results in a hazardous material spill in a densely population area, such as near the Cities of Monongahela or Washington. Such an event would constitute an immediate health hazard to the population and require an evacuation of the surrounding area.

4.3.15.3. Past Occurrence

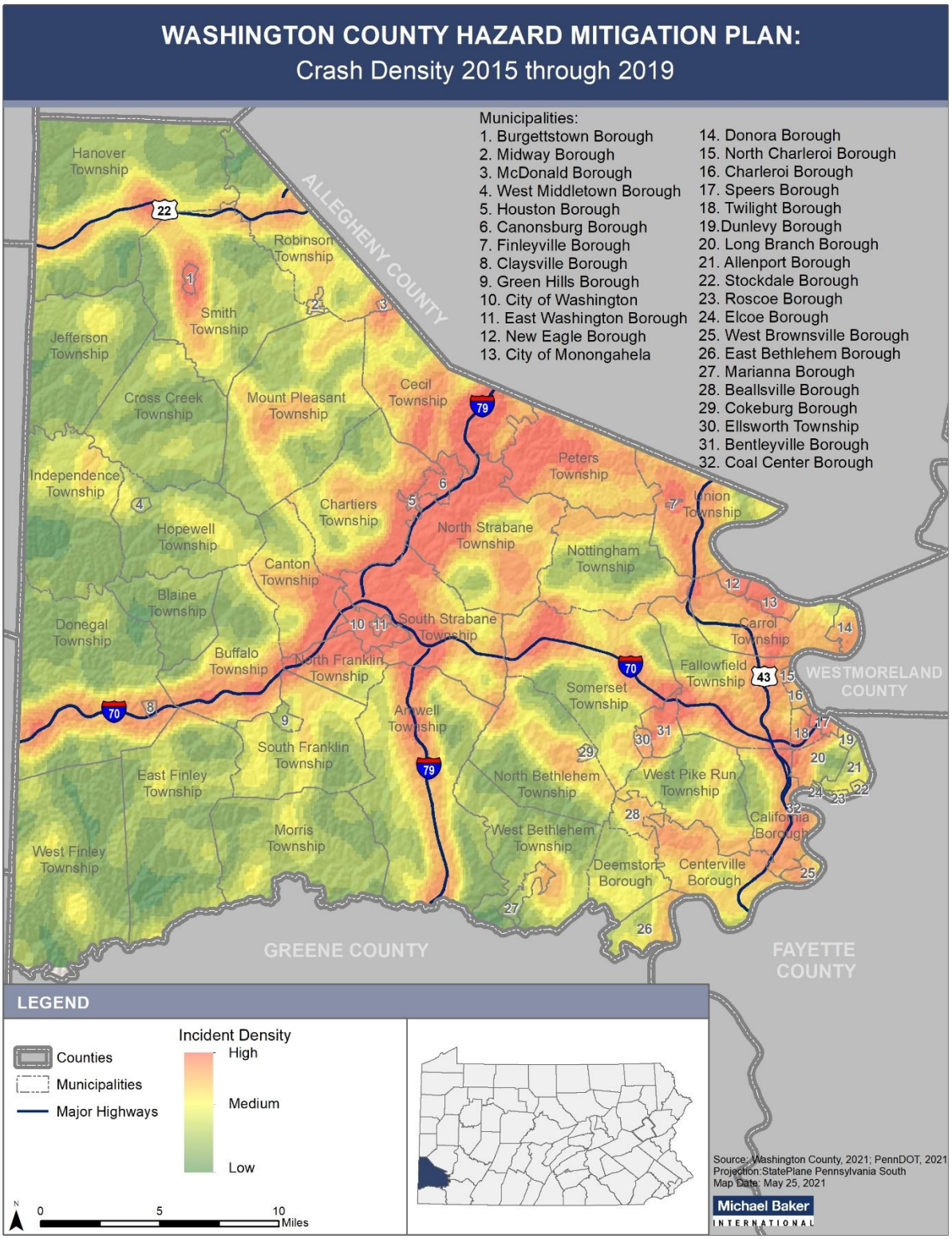
Vehicle crashes continues to be a risk throughout the County. PennDOT statistics for reportable vehicle crashes in Washington County are shown in Table 4.3.14-1.

Table 4.3.15-1 Reportable Traffic Crash Data, 2009-2019 (PennDOT, 2019c)

YEAR	REPORTABLE CRASHES	# FATAL CRASHES	# DEATHS	# INJURY CRASHES
2009	1,898	31	33	902
2010	1,934	19	24	945
2011	2,036	24	27	897
2012	2,084	25	29	955
2013	1,972	27	29	884
2014	1,956	28	29	859
2015	1,925	21	23	843
2016	2,036	22	22	812
2017	1,926	25	27	814
2018	2,038	27	29	804
2019	1,899	23	24	741

Figure 4.3.14-3 shows the density of transportation crashes throughout Washington County. Red and yellow areas show roadways where the most crashes occurred between 2015 and 2019. In Washington County, most incidents occur along Routes I-70 and I-79, and US 22 and US 43. Crashes are also densely concentrated around the more populated communities in the northeastern portions of the County.

Figure 4.3.15-3 Washington County Transportation Crash Density, 2015-2019



4.3.15.4. Future Occurrence

The north central area of Washington County has experienced some of the fastest traffic growth in the region, creating congestion and mobility issues along key corridors. The growth of large business park developments along with substantial infill development of new single family residential, commercial, and industrial developments are placing stress on existing transportation systems (SPC, 2019). The number of transportation related incidents is expected to increase with further projected growth. Recognizing the changing transportation network within the County and the steadily growing transportation volume, the number of incidents 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 incidents can be considered *likely*, according to the Risk Factor Methodology (see Table 4.4-1).

4.3.15.5. Vulnerability Assessment

A transportation-related incident can occur on any stretch of road in Washington County. However, severe incidents 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 incidents occurring. Incidents may also occur on any rail line or air flight path.

Table 4.3.15-2 shows the structures that are vulnerable to traffic incidents and Table 4.3.15-3 shows the critical facilities that are vulnerable to traffic incidents. Tables 4.3.15-4 through 4.3.15-6 show that structures vulnerable to traffic incidents by land use.

Table 4.3.15-2 Structures Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	STRUCTURES WITHIN .5 MILES OF A RAILWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A RAILWAY	STRUCTURES WITHIN .5 MILES OF AN AIRPORT	PERCENT STRUCTURES WITHIN .5 MILES OF AN AIRPORT
Allenport Borough	259	0	0%	254	98%	0	0%
Amwell Township	1,683	275	16%	0	0%	0	0%
Beallsville Borough	226	0	0%	0	0%	0	0%
Bentleyville Borough	1,118	116	10%	973	87%	0	0%
Blaine Township	278	0	0%	0	0%	0	0%
Buffalo Township	863	235	27%	120	14%	0	0%
Burgettstown Borough	643	0	0%	0	0%	0	0%
California Borough	1,875	717	38%	1,268	68%	0	0%
Canonsburg Borough	4,067	1,630	40%	2,611	64%	223	5%
Canton Township	3,874	1,102	28%	1,228	32%	0	0%
Carroll Township	2,547	377	15%	1,171	46%	76	3%
Cecil Township	6,445	928	14%	2,223	34%	0	0%
Centerville Borough	1,733	488	28%	545	31%	0	0%
Charleroi Borough	2,046	0	0%	2,045	100%	0	0%
Chartiers Township	4,155	1,054	25%	1,663	40%	0	0%
Claysville Borough	330	308	93%	0	0%	0	0%
Coal Center Borough	83	83	100%	83	100%	0	0%
Cokeburg Borough	368	0	0%	0	0%	0	0%
Cross Creek Township	770	0	0%	253	33%	0	0%
Deemston Borough	365	0	0%	0	0%	0	0%
Donegal Township	1,246	657	53%	0	0%	9	1%
Donora Borough	2,413	0	0%	2,064	86%	0	0%
Dunlevy Borough	205	0	0%	205	100%	0	0%
East Bethlehem Township	1,199	0	0%	1,141	95%	0	0%
East Finley Township	623	8	1%	16	3%	0	0%
East Washington Borough	645	162	25%	350	54%	34	5%

Table 4.3.15-2 Structures Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	STRUCTURES WITHIN .5 MILES OF A RAILWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A RAILWAY	STRUCTURES WITHIN .5 MILES OF AN AIRPORT	PERCENT STRUCTURES WITHIN .5 MILES OF AN AIRPORT
Elco Borough	146	0	0%	146	100%	0	0%
Ellsworth Borough	461	0	0%	421	91%	6	1%
Fallowfield Township	2,116	1,098	52%	1,020	48%	0	0%
Finleyville Borough	214	0	0%	214	100%	8	4%
Green Hills Borough	6	0	0%	0	0%	0	0%
Hanover Township	1,253	468	37%	0	0%	0	0%
Hopewell Township	448	0	0%	1	0%	0	0%
Houston Borough	565	121	21%	535	95%	0	0%
Independence Township	737	0	0%	247	34%	0	0%
Jefferson Township	543	0	0%	43	8%	0	0%
Long Branch Borough	232	70	30%	25	11%	0	0%
Marianna Borough	262	0	0%	256	98%	0	0%
McDonald Borough	954	0	0%	0	0%	0	0%
Midway Borough	417	0	0%	0	0%	52	12%
Monongahela, City of	2,065	0	0%	1,918	93%	41	2%
Morris Township	467	0	0%	0	0%	0	0%
Mount Pleasant Township	1,705	0	0%	546	32%	0	0%
New Eagle Borough	1,033	0	0%	930	90%	0	0%
North Bethlehem Township	779	0	0%	45	6%	21	3%
North Charleroi Borough	578	0	0%	578	100%	0	0%
North Franklin Township	2,023	464	23%	687	34%	5	0%
North Strabane Township	7,373	1,995	27%	1,852	25%	634	9%
Nottingham Township	1,329	2	0%	543	41%	3	0%
Peters Township	9,029	0	0%	1,268	14%	45	0%
Robinson Township	907	66	7%	0	0%	95	10%
Roscoe Borough	392	0	0%	392	100%	0	0%

Table 4.3.15-2 Structures Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A MAJOR HIGHWAY	STRUCTURES WITHIN .5 MILES OF A RAILWAY	PERCENT STRUCTURES WITHIN .5 MILES OF A RAILWAY	STRUCTURES WITHIN .5 MILES OF AN AIRPORT	PERCENT STRUCTURES WITHIN .5 MILES OF AN AIRPORT
Smith Township	2,125	42	2%	0	0%	81	4%
Somerset Township	1,251	296	24%	336	27%	148	12%
South Franklin Township	1,313	84	6%	0	0%	90	7%
South Strabane Township	4,266	1,831	43%	969	23%	603	14%
Speers Borough	602	423	70%	584	97%	0	0%
Stockdale Borough	250	0	0%	250	100%	0	0%
Twilight Borough	108	88	81%	54	50%	0	0%
Union Township	2,861	607	21%	1,462	51%	147	5%
Washington, City of	5,433	2,117	39%	2,792	51%	1,026	19%
West Bethlehem Township	708	0	0%	243	34%	0	0%
West Brownsville Borough	525	0	0%	514	98%	0	0%
West Finley Township	435	0	0%	0	0%	0	0%
West Middletown Borough	78	0	0%	0	0%	0	0%
West Pike Run Township	833	0	0%	0	0%	0	0%
TOTAL	96,881	17,912	18%	37,084	38%	3,347	3%

Table 4.3.15-3 Critical Facilities Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT
Allenport Borough	8	0	0%	8	100%	0	0%
Amwell Township	61	27	44%	0	0%	0	0%
Beallsville Borough	9	0	0%	0	0%	0	0%
Bentleyville Borough	13	3	23%	10	77%	0	0%
Blaine Township	10	0	0%	0	0%	0	0%
Buffalo Township	16	5	31%	1	6%	0	0%
Burgettstown Borough	4	0	0%	0	0%	0	0%
California Borough	27	9	33%	15	56%	0	0%
Canonsburg Borough	23	16	70%	21	91%	1	4%
Canton Township	44	23	52%	9	20%	0	0%
Carroll Township	46	16	35%	24	52%	4	9%
Cecil Township	66	18	27%	30	45%	0	0%
Centerville Borough	19	5	26%	13	68%	0	0%
Charleroi Borough	21	0	0%	21	100%	0	0%
Chartiers Township	66	23	35%	28	42%	0	0%
Claysville Borough	4	4	100%	0	0%	0	0%
Coal Center Borough	1	1	100%	1	100%	0	0%
Cokeburg Borough	4	0	0%	0	0%	0	0%
Cross Creek Township	27	0	0%	8	30%	0	0%
Deemston Borough	14	0	0%	0	0%	0	0%
Donegal Township	36	19	53%	0	0%	2	6%
Donora Borough	24	0	0%	18	75%	0	0%
Dunlevy Borough	8	0	0%	8	100%	0	0%
East Bethlehem Township	42	0	0%	34	81%	0	0%
East Finley Township	17	0	0%	1	6%	0	0%

Table 4.3.15-3 Critical Facilities Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT
East Washington Borough	1	0	0%	1	100%	0	0%
Elco Borough	3	0	0%	3	100%	0	0%
Ellsworth Borough	7	0	0%	7	100%	0	0%
Fallowfield Township	65	18	28%	23	35%	0	0%
Finleyville Borough	4	0	0%	4	100%	0	0%
Green Hills Borough	4	0	0%	0	0%	0	0%
Hanover Township	30	15	50%	0	0%	0	0%
Hopewell Township	8	0	0%	0	0%	0	0%
Houston Borough	3	2	67%	3	100%	0	0%
Independence Township	17	0	0%	5	29%	0	0%
Jefferson Township	17	0	0%	0	0%	0	0%
Long Branch Borough	4	2	50%	0	0%	0	0%
Marianna Borough	12	0	0%	10	83%	0	0%
McDonald Borough	7	0	0%	0	0%	0	0%
Midway Borough	1	0	0%	0	0%	0	0%
Monongahela, City of	23	0	0%	23	100%	0	0%
Morris Township	13	0	0%	0	0%	0	0%
Mount Pleasant Township	51	0	0%	16	31%	0	0%
New Eagle Borough	21	0	0%	20	95%	0	0%
North Bethlehem Township	22	0	0%	1	5%	1	5%
North Charleroi Borough	4	0	0%	4	100%	0	0%
North Franklin Township	42	11	26%	10	24%	0	0%
North Strabane Township	76	19	25%	41	54%	12	16%
Nottingham Township	16	1	6%	4	25%	0	0%
Peters Township	78	0	0%	9	12%	0	0%

Table 4.3.15-3 Critical Facilities Vulnerable to Transportation Incidents in Washington County.

MUNICIPALITY	TOTAL CRITICAL FACILITIES	CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A MAJOR HIGHWAY	CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF A RAILWAY	CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT	PERCENT CRITICAL FACILITIES WITHIN .5 MILES OF AN AIRPORT
Robinson Township	34	11	32%	0	0%	2	6%
Roscoe Borough	5	0	0%	5	100%	0	0%
Smith Township	51	6	12%	0	0%	1	2%
Somerset Township	78	23	29%	28	36%	12	15%
South Franklin Township	19	1	5%	0	0%	4	21%
South Strabane Township	50	25	50%	19	38%	9	18%
Speers Borough	13	11	85%	13	100%	0	0%
Stockdale Borough	5	0	0%	5	100%	0	0%
Twilight Borough	2	2	100%	1	50%	0	0%
Union Township	52	15	29%	28	54%	1	2%
Washington, City of	47	14	30%	33	70%	7	15%
West Bethlehem Township	32	0	0%	10	31%	0	0%
West Brownsville Borough	5	0	0%	5	100%	0	0%
West Finley Township	24	0	0%	0	0%	0	0%
West Middletown Borough	3	0	0%	0	0%	0	0%
West Pike Run Township	16	0	0%	0	0%	0	0%
TOTAL	1,575	345	22%	581	37%	56	4%

Table 4.3.15-4 Structures Vulnerable to Highway Incidents by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	0	0	0	0	0	0	0	0	0
Amwell Township	24	5	6	0	3	226	11	0	275
Beallsville Borough	0	0	0	0	0	0	0	0	0
Bentleyville Borough	1	36	0	0	2	77	0	0	116
Blaine Township	0	0	0	0	0	0	0	0	0
Buffalo Township	13	18	0	0	1	199	4	0	235
Burgettstown Borough	0	0	0	0	0	0	0	0	0
California Borough	8	18	3	3	5	574	106	0	717
Canonsburg Borough	0	248	9	31	12	1,330	0	0	1,630
Canton Township	0	82	4	31	0	985	0	0	1,102
Carroll Township	10	6	2	3	8	245	103	0	377
Cecil Township	2	84	37	14	9	776	3	0	928
Centerville Borough	3	4	2	2	6	408	62	1	488
Charleroi Borough	0	0	0	0	0	0	0	0	0
Chartiers Township	79	43	21	51	10	850	0	0	1,054
Claysville Borough	0	31	2	0	2	273	0	0	308
Coal Center Borough	0	0	3	0	0	80	0	0	83
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	0	0	0	0	0	0	0	0	0
Deemston Borough	0	0	0	0	0	0	0	0	0
Donegal Township	30	33	8	5	12	561	8	0	657
Donora Borough	0	0	0	0	0	0	0	0	0
Dunlevy Borough	0	0	0	0	0	0	0	0	0
East Bethlehem Township	0	0	0	0	0	0	0	0	0
East Finley Township	0	0	0	0	0	7	1	0	8
East Washington Borough	0	0	0	0	3	159	0	0	162
Elco Borough	0	0	0	0	0	0	0	0	0
Ellsworth Borough	0	0	0	0	0	0	0	0	0

Table 4.3.15-4 Structures Vulnerable to Highway Incidents by Land Use in Washington County.									
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Fallowfield Township	9	11	4	3	17	963	91	0	1,098
Finleyville Borough	0	0	0	0	0	0	0	0	0
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	6	34	8	0	19	397	3	0	468
Hopewell Township	0	0	0	0	0	0	0	0	0
Houston Borough	0	7	0	0	4	110	0	0	121
Independence Township	0	0	0	0	0	0	0	0	0
Jefferson Township	0	0	0	0	0	0	0	0	0
Long Branch Borough	0	0	0	0	3	66	1	0	70
Marianna Borough	0	0	0	0	0	0	0	0	0
McDonald Borough	0	0	0	0	0	0	0	0	0
Midway Borough	0	0	0	0	0	0	0	0	0
Monongahela, City of	0	0	0	0	0	0	0	0	0
Morris Township	0	0	0	0	0	0	0	0	0
Mount Pleasant Township	0	0	0	0	0	0	0	0	0
New Eagle Borough	0	0	0	0	0	0	0	0	0
North Bethlehem Township	0	0	0	0	0	0	0	0	0
North Charleroi Borough	0	0	0	0	0	0	0	0	0
North Franklin Township	5	92	3	0	4	360	0	0	464
North Strabane Township	1	101	108	19	16	1,750	0	0	1,995
Nottingham Township	0	0	0	0	1	1	0	0	2
Peters Township	0	0	0	0	0	0	0	0	0
Robinson Township	6	10	6	0	0	43	1	0	66
Roscoe Borough	0	0	0	0	0	0	0	0	0
Smith Township	3	0	3	0	1	33	2	0	42
Somerset Township	17	28	3	0	6	240	2	0	296
South Franklin Township	0	0	0	0	0	84	0	0	84
South Strabane Township	13	178	37	81	40	1,475	6	1	1,831

Table 4.3.15-4 Structures Vulnerable to Highway Incidents by Land Use in Washington County.									
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Speers Borough	0	28	0	20	0	375	0	0	423
Stockdale Borough	0	0	0	0	0	0	0	0	0
Twilight Borough	0	1	0	1	1	85	0	0	88
Union Township	6	4	3	0	4	497	93	0	607
Washington, City of	0	167	0	2	8	1,940	0	0	2,117
West Bethlehem Township	0	0	0	0	0	0	0	0	0
West Brownsville Borough	0	0	0	0	0	0	0	0	0
West Finley Township	0	0	0	0	0	0	0	0	0
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	0	0	0	0	0	0	0	0	0
TOTAL	236	1,269	272	266	197	15,169	497	2	17,912

Table 4.3.15-5 Structures Vulnerable to Railway Incidents by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	0	1	1	2	3	246	1	0	254
Amwell Township	0	0	0	0	0	0	0	0	0
Beallsville Borough	0	0	0	0	0	0	0	0	0
Bentleyville Borough	3	135	1	0	5	828	1	0	973
Blaine Township	0	0	0	0	0	0	0	0	0
Buffalo Township	3	0	2	0	0	114	1	0	120
Burgettstown Borough	0	0	0	0	0	0	0	0	0
California Borough	1	175	0	3	51	998	39	1	1,268
Canonsburg Borough	0	298	8	31	14	2,260	0	0	2,611
Canton Township	3	78	7	4	2	1,134	0	0	1,228
Carroll Township	14	15	9	7	9	1,049	68	0	1,171
Cecil Township	4	84	66	19	303	1,741	6	0	2,223
Centerville Borough	5	12	4	2	5	498	18	1	545
Charleroi Borough	0	381	1	7	10	1,644	1	1	2,045
Chartiers Township	118	46	23	51	12	1,413	0	0	1,663
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	3	0	0	80	0	0	83
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	13	16	8	0	11	203	2	0	253
Deemston Borough	0	0	0	0	0	0	0	0	0
Donegal Township	0	0	0	0	0	0	0	0	0
Donora Borough	0	152	3	17	1	1,889	2	0	2,064
Dunlevy Borough	0	9	1	0	1	194	0	0	205
East Bethlehem Township	1	43	5	2	15	1,072	0	1	1,141
East Finley Township	1	0	0	0	0	10	2	0	16
East Washington Borough	0	3	0	0	7	340	0	0	350
Elco Borough	0	0	1	1	1	143	0	0	146
Ellsworth Borough	0	9	1	0	2	409	0	0	421

Table 4.3.15-5 Structures Vulnerable to Railway Incidents by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Fallowfield Township	12	15	4	3	10	948	28	0	1,020
Finleyville Borough	0	83	0	0	0	131	0	0	214
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	0	0	0	0	0	0	0	0	0
Hopewell Township	1	0	0	0	0	0	0	0	1
Houston Borough	0	65	0	0	4	466	0	0	535
Independence Township	2	24	1	0	0	217	3	0	247
Jefferson Township	2	0	2	0	0	39	0	0	43
Long Branch Borough	0	0	0	0	2	23	0	0	25
Marianna Borough	0	4	0	1	0	250	0	1	256
McDonald Borough	0	0	0	0	0	0	0	0	0
Midway Borough	0	0	0	0	0	0	0	0	0
Monongahela, City of	0	373	3	9	7	1,525	1	0	1,918
Morris Township	0	0	0	0	0	0	0	0	0
Mount Pleasant Township	29	22	5	0	6	481	3	0	546
New Eagle Borough	0	122	0	13	1	794	0	0	930
North Bethlehem Township	6	0	0	1	0	37	1	0	45
North Charleroi Borough	0	7	0	1	0	570	0	0	578
North Franklin Township	2	38	6	2	3	636	0	0	687
North Strabane Township	37	126	91	15	16	1,564	3	0	1,852
Nottingham Township	7	6	5	0	1	524	0	0	543
Peters Township	2	6	7	0	7	1,246	0	0	1,268
Robinson Township	0	0	0	0	0	0	0	0	0
Roscoe Borough	0	11	0	1	0	379	0	1	392
Smith Township	0	0	0	0	0	0	0	0	0
Somerset Township	8	21	5	0	3	296	3	0	336
South Franklin Township	0	0	0	0	0	0	0	0	0
South Strabane Township	4	111	32	10	35	776	0	1	969

Table 4.3.15-5 Structures Vulnerable to Railway Incidents by Land Use in Washington County.									
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Speers Borough	0	42	0	20	0	522	0	0	584
Stockdale Borough	0	1	0	0	1	248	0	0	250
Twilight Borough	1	4	1	1	1	46	0	0	54
Union Township	13	13	12	6	26	1,297	93	0	1,462
Washington, City of	0	677	3	26	54	2,030	2	0	2,792
West Bethlehem Township	6	14	2	0	2	216	3	0	243
West Brownsville Borough	0	26	2	0	3	482	1	0	514
West Finley Township	0	0	0	0	0	0	0	0	0
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	0	0	0	0	0	0	0	0	0
TOTAL	298	3,268	325	255	634	32,008	282	7	37,084

Table 4.3.15-6 Structures Vulnerable to Air Incidents by Land Use in Washington County.

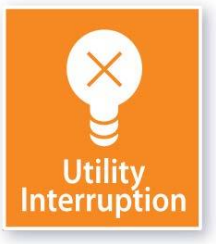
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Allenport Borough	0	0	0	0	0	0	0	0	0
Amwell Township	0	0	0	0	0	0	0	0	0
Beallsville Borough	0	0	0	0	0	0	0	0	0
Bentleyville Borough	0	0	0	0	0	0	0	0	0
Blaine Township	0	0	0	0	0	0	0	0	0
Buffalo Township	0	0	0	0	0	0	0	0	0
Burgettstown Borough	0	0	0	0	0	0	0	0	0
California Borough	0	0	0	0	0	0	0	0	0
Canonsburg Borough	0	0	0	0	2	221	0	0	223
Canton Township	0	0	0	0	0	0	0	0	0
Carroll Township	0	4	0	0	2	70	0	0	76
Cecil Township	0	0	0	0	0	0	0	0	0
Centerville Borough	0	0	0	0	0	0	0	0	0
Charleroi Borough	0	0	0	0	0	0	0	0	0
Chartiers Township	0	0	0	0	0	0	0	0	0
Claysville Borough	0	0	0	0	0	0	0	0	0
Coal Center Borough	0	0	0	0	0	0	0	0	0
Cokeburg Borough	0	0	0	0	0	0	0	0	0
Cross Creek Township	0	0	0	0	0	0	0	0	0
Deemston Borough	0	0	0	0	0	0	0	0	0
Donegal Township	0	0	0	0	1	8	0	0	9
Donora Borough	0	0	0	0	0	0	0	0	0
Dunlevy Borough	0	0	0	0	0	0	0	0	0
East Bethlehem Township	0	0	0	0	0	0	0	0	0
East Finley Township	0	0	0	0	0	0	0	0	0
East Washington Borough	0	0	0	0	0	34	0	0	34
Elco Borough	0	0	0	0	0	0	0	0	0
Ellsworth Borough	0	0	0	0	0	6	0	0	6

Table 4.3.15-6 Structures Vulnerable to Air Incidents by Land Use in Washington County.

MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Fallowfield Township	0	0	0	0	0	0	0	0	0
Finleyville Borough	0	7	0	0	0	1	0	0	8
Green Hills Borough	0	0	0	0	0	0	0	0	0
Hanover Township	0	0	0	0	0	0	0	0	0
Hopewell Township	0	0	0	0	0	0	0	0	0
Houston Borough	0	0	0	0	0	0	0	0	0
Independence Township	0	0	0	0	0	0	0	0	0
Jefferson Township	0	0	0	0	0	0	0	0	0
Long Branch Borough	0	0	0	0	0	0	0	0	0
Marianna Borough	0	0	0	0	0	0	0	0	0
McDonald Borough	0	0	0	0	0	0	0	0	0
Midway Borough	0	0	0	0	0	52	0	0	52
Monongahela, City of	0	0	0	0	0	41	0	0	41
Morris Township	0	0	0	0	0	0	0	0	0
Mount Pleasant Township	0	0	0	0	0	0	0	0	0
New Eagle Borough	0	0	0	0	0	0	0	0	0
North Bethlehem Township	1	0	1	0	0	18	1	0	21
North Charleroi Borough	0	0	0	0	0	0	0	0	0
North Franklin Township	1	0	0	0	0	4	0	0	5
North Strabane Township	2	26	89	8	7	500	2	0	634
Nottingham Township	0	0	0	0	0	3	0	0	3
Peters Township	0	0	0	0	0	45	0	0	45
Robinson Township	1	0	1	0	2	90	1	0	95
Roscoe Borough	0	0	0	0	0	0	0	0	0
Smith Township	0	0	0	0	0	81	0	0	81
Somerset Township	2	11	1	0	2	132	0	0	148
South Franklin Township	0	4	0	0	2	65	19	0	90
South Strabane Township	0	58	0	14	2	529	0	0	603

Table 4.3.15-6 Structures Vulnerable to Air Incidents by Land Use in Washington County.									
MUNICIPALITY	AGRICULTURE	COMMERCIAL	FOREST	INDUSTRIAL	OTHER	RESIDENTIAL	UTILITIES	WATER	TOTAL
Speers Borough	0	0	0	0	0	0	0	0	0
Stockdale Borough	0	0	0	0	0	0	0	0	0
Twilight Borough	0	0	0	0	0	0	0	0	0
Union Township	1	2	0	0	0	144	0	0	147
Washington, City of	0	26	0	0	5	995	0	0	1,026
West Bethlehem Township	0	0	0	0	0	0	0	0	0
West Brownsville Borough	0	0	0	0	0	0	0	0	0
West Finley Township	0	0	0	0	0	0	0	0	0
West Middletown Borough	0	0	0	0	0	0	0	0	0
West Pike Run Township	0	0	0	0	0	0	0	0	0
TOTAL	8	138	92	22	25	3,039	23	0	3,347

4.3.16. Utility Interruption



4.3.16.1. 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 incidents, 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 incidents or wind damage.

Utility interruptions and power failures can take place throughout the County. Washington County is served electric utilities through Duqesne Light Company, Washington Energy Co, and West Penn Power. Gas utilities are offered by Chartiers Natural Gas Co Inc and Columbia Gas of Pennsylvania.

According to the 2019 5-year American Community Survey, in Washington County, 66.1% of housing units use utility gas, followed by 19.9% of homes using electricity as their heat source (US Census, 2019). As a result, an interruption in either of those utilities could affect a significant number of residents. In addition, an increasing reliance on internet access and telecommunications could also impact a large number of residents at any given time.

There are 38 public/community water systems and sewer systems in Washington 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 (WCPC, 2020).

4.3.16.2. 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 Washington 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.

4.3.16.3. Past Occurrence

Energy emergencies may be caused by nationwide shortages or localized supply problems. Washington 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 NOAA NCEI storm events database tracks weather related events across the Country. Events include narratives about the location and impacts experienced. There are a large number of events narratives that include notes of power lines being downed or power outages from weather related events. 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.

In November 2020, high winds in Southwestern Pennsylvania caused damage to trees and power lines. More than 13,000 customers of West Penn Power Co. and Duqesne Light were without power for one afternoon as a result of the event. It is estimated that 2,340 of these customers were in Washington County (Napsha & Rittmeyer, 2020).

In Spring 2021, the Colonial Pipeline was shut down for five days following a cyberattack. The pipeline is the largest one in the United States, running from the Gulf Coast to New York. It delivers about 45% of the fuel consumed on the East Coast. This led to gas shortages in some areas and increased prices in many parts of Pennsylvania as supply chains worked to close the gap while the Colonial Pipeline secured its system (Lindstrom, 2021).

4.3.16.4. 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 Washington County 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 Washington 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.

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

RF values were obtained by assigning varying degrees of risk to five categories for each of the 16 hazards profiled in the 2021 HMP Update. Those categories include *probability*, *impact*, *spatial extent*, *warning time,* and *duration*. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor is shown in Table 4.4.1-1. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation:

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

Table 4.4.1-1 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 4.4.1-1 Summary of Risk Factor Approach Used to Rank Hazard Risk

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

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

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

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4.2-1 lists the Risk Factor calculated for each of the 15 hazards identified in the 2021 HMP Update. Hazards identified as *high* risk have risk factors of 2.5. or greater. Risk Factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with Risk Factors 1.9 and less are considered *low* risk.

Table 4.4.2-1 Ranking of Hazard Types Based on Risk Factor Methodology

RISK	NATURAL HAZARD	RISK ASSESSMENT CATEGORY					RISK FACTOR
		PROBABILITY	IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic, Infectious Disease (N)	2	4	4	3	4	3.3
	Flood, Flash Flood, Ice Jam (N)	4	2	3	3	2	2.9
	Landslide (N)	4	2	3	4	1	2.9
	Winter Storm (N)	3	2	4	2	3	2.8
	Tornado, Windstorm (N)	3	3	3	2	1	2.7
	Subsidence, Sinkhole (N)	4	2	2	4	1	2.7
	Transportation Incident (M)	4	2	1	4	1	2.5
MODERATE	Conventional Oil and Gas Wells (M)	3	2	2	3	2	2.4
	Unconventional Oil and Gas Wells (M)	3	2	2	3	2	2.4
	Opioid Addiction & Response (M)	4	1	2	1	4	2.4
	Drought (N)	2	2	3	1	4	2.3
	Dam Failure (M)	1	2	3	4	3	2.2
	Utility Interruption (M)	3	1	2	4	2	2.2
	Civil Disturbance (M)	2	2	2	3	2	2.1
LOW	Radon Exposure (N)	2	1	2	1	4	1.8
	Earthquake (N)	1	2	2	4	1	1.8

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

A risk assessment result for the entire County does not mean that each municipality the same risk to each hazard. Municipalities completed a *Hazard Risk Assessment Survey* to during the planning process evaluate their jurisdictional risk to each hazard. Results from these surveys

were reassessed by the HMPT, and the update risk assessment was used to complete Table 4.4.2-2 which shows the different municipalities in Washington 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 Table 4.4.2-3 Calculated Countywide Risk Factor by Hazard and Jurisdictional Risk

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR															
	Pandemic, Infectious Disease (N)	Flood, Flash Flood, Ice Jam (N)	Landslide (N)	Winter Storm (N)	Tornado, Windstorm (N)	Subsidence, Sinkhole (N)	Transportation Incident (M)	Conventional Oil and Gas Wells (M)	Unconventional Oil and Gas Wells (M)	Opioid Addiction & Response (M)	Drought (N)	Dam Failure (M)	Utility Interruption (M)	Civil Disturbance (M)	Radon Exposure (N)	Earthquake (M)
	3.3	2.9	2.9	2.8	2.7	2.7	2.5	2.4	2.4	2.4	2.3	2.2	2.2	2.1	1.8	1.8
Allenport Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Amwell Township	>	=	=	<	=	=	>	=	=	>	=	>	>	>	=	=
Beallsville Borough	>	=	=	<	=	=	>	=	=	>	=	>	>	>	=	=
Bentleyville Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Blaine Township	>	=	=	<	=	=	>	=	=	>	>	=	>	>	=	=
Buffalo Township	>	<	=	<	>	=	>	=	=	>	>	=	>	>	=	=
Burgettstown Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
California Borough	>	>	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Canonsburg Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Canton Township	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Carroll Township	>	=	>	<	>	>	>	=	=	>	=	=	>	>	=	>
Cecil Township	>	<	=	<	>	=	>	=	=	>	=	=	>	>	=	>
Centerville Borough	>	=	=	<	>	=	>	=	=	>	=	>	>	>	=	=
Charleroi Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Chartiers Township	>	>	>	<	>	>	>	=	=	>	=	=	>	>	=	=
Claysville Borough	>	<	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Coal Center Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Cokeburg Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=

Table 4 Table 4.4.2-3 Calculated Countywide Risk Factor by Hazard and Jurisdictional Risk

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR															
	Pandemic, Infectious Disease (N)	Flood, Flash Flood, Ice Jam (N)	Landslide (N)	Winter Storm (N)	Tornado, Windstorm (N)	Subsidence, Sinkhole (N)	Transportation Incident (M)	Conventional Oil and Gas Wells (M)	Unconventional Oil and Gas Wells (M)	Opioid Addiction & Response (M)	Drought (N)	Dam Failure (M)	Utility Interruption (M)	Civil Disturbance (M)	Radon Exposure (N)	Earthquake (M)
	3.3	2.9	2.9	2.8	2.7	2.7	2.5	2.4	2.4	2.4	2.3	2.2	2.2	2.1	1.8	1.8
Cross Creek Township	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Deemston Borough	>	=	=	<	>	=	>	=	=	>	=	>	>	>	=	=
Donegal Township	>	=	=	<	=	=	>	=	=	>	=	>	>	>	=	=
Donora Borough	>	=	>	<	=	>	>	=	=	>	=	=	>	>	=	=
Dunlevy Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
East Bethlehem Township	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
East Finley Township	>	<	=	<	>	=	>	=	=	>	>	=	>	>	=	=
East Washington Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Elco Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Ellsworth Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Fallowfield Township	>	=	=	<	>	=	>	=	=	>	=	>	>	>	=	=
Finleyville Borough	>	=>	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Green Hills Borough	>	=<	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Hanover Township	>	=	>	<	>	>	>	=	=	>	=	=	>	>	=	=
Hopewell Township	>	=<	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Houston Borough	>	>	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Independence Township	>	=<	=	<	>	=	>	=	=	>	>	=	>	>	=	=
Jefferson Township	>	=	>	<	>	>	>	=	=	>	=	=	>	>	=	=

Table 4 Table 4.4.2-3 Calculated Countywide Risk Factor by Hazard and Jurisdictional Risk

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR															
	Pandemic, Infectious Disease (N)	Flood, Flash Flood, Ice Jam (N)	Landslide (N)	Winter Storm (N)	Tornado, Windstorm (N)	Subsidence, Sinkhole (N)	Transportation Incident (M)	Conventional Oil and Gas Wells (M)	Unconventional Oil and Gas Wells (M)	Opioid Addiction & Response (M)	Drought (N)	Dam Failure (M)	Utility Interruption (M)	Civil Disturbance (M)	Radon Exposure (N)	Earthquake (M)
	3.3	2.9	2.9	2.8	2.7	2.7	2.5	2.4	2.4	2.4	2.3	2.2	2.2	2.1	1.8	1.8
Long Branch Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Marianna Borough	>	=	=	<	>	=	>	=	=	>	=	>	>	>	=	>
McDonald Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Midway Borough	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Monongahela, City of	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Morris Township	>	=	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Mount Pleasant Township	>	=<	=	<	=	=	>	=	=	>	=	=	>	>	=	=
New Eagle Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	>
North Bethlehem Township	>	=<	=	<	=	=	>	=	=	>	=	=	>	>	=	=
North Charleroi Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
North Franklin Township	>	=>	=	<	>	=	>	=	=	>	=	=	>	>	=	=
North Strabane Township	>	=>	>	<	>	>	>	>	>	>	=	=	>	>	=	=
Nottingham Township	>	=<	=	<	>	=	>	=	=	>	=	>	>	>	=	>
Peters Township	>	=>	>	<	=	>	>	=	=	>	=	=	>	>	=	=
Robinson Township	>	=<	>	<	=	>	>	=	=	>	=	=	>	>	=	=
Roscoe Borough	>	=>	=	<	=	=	>	=	=	>	>	=	>	>	=	=
Smith Township	>	=<	>	<	>	>	>	=	=	>	=	=	>	>	=	=

Table 4 Table 4.4.2-3 Calculated Countywide Risk Factor by Hazard and Jurisdictional Risk

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR															
	Pandemic, Infectious Disease (N)	Flood, Flash Flood, Ice Jam (N)	Landslide (N)	Winter Storm (N)	Tornado, Windstorm (N)	Subsidence, Sinkhole (N)	Transportation Incident (M)	Conventional Oil and Gas Wells (M)	Unconventional Oil and Gas Wells (M)	Opioid Addiction & Response (M)	Drought (N)	Dam Failure (M)	Utility Interruption (M)	Civil Disturbance (M)	Radon Exposure (N)	Earthquake (M)
	3.3	2.9	2.9	2.8	2.7	2.7	2.5	2.4	2.4	2.4	2.3	2.2	2.2	2.1	1.8	1.8
Somerset Township	>	=<	=	<	=	=	>	=	=	>	=	>	>	>	=	>
South Franklin Township	>	=<	=	<	=	=	>	=	=	>	>	=	>	>	=	=
South Strabane Township	>	=<	>	<	=	>	>	=	=	>	=	=	>	>	=	=
Speers Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Stockdale Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
Twilight Borough	>	=<	=	<	>	=	>	=	=	>	=	=	>	>	=	=
Union Township	>	=<	>	<	=	>	>	=	=	>	=	=	>	>	=	>
Washington, City of	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
West Bethlehem Township	>	=<	=	<	=	=	>	=	=	>	=	>	>	>	=	>
West Brownsville Borough	>	=	=	<	=	=	>	=	=	>	=	=	>	>	=	=
West Finley Township	>	=<	=	<	=	=	>	=	=	>	>	>	>	>	=	=
West Middletown Borough	>	=<	=	<	=	=	>	=	=	>	=	=	>	>	=	=
West Pike Run Township	>	=<	=	<	>	=	>	=	=	>	=	>	>	>	=	=

4.4.3. Potential Loss Estimates

Based on various kinds of available data, potential loss estimates were established for flood, flash flood, and ice jam. Estimates provided in this section are based on Hazus version 4.2, geospatial analysis, and previous events. Estimates are considered *potential* in that they generally represent losses that could occur in a Countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

- Replacement Value: Current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials.
- Content Loss: Value of building's contents, typically measured as a percentage of the building replacement value.
- Functional Loss: The value of a building's use or function that would be lost if it were damaged or closed.
- Displacement Cost: The dollar amount required for relocation of the function (business or service) to another structure following a hazard event.

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

- Updated demographic data from the 2010 Census;
- Updated essential facilities data from the County and other sources
- Updated user defined facilities from the County and other sources

Using these datasets in Hazus, total building-related losses from a 1%-annual-chance flood in Washington County are estimated to equal $546 million. Business interruption makes up 50% of the total estimated building-related losses. Residential occupancies make up approximately 21% of the total estimated building-related losses. Damages would be most significant along the I-79 corridor in Cecil Township. Total economic loss, including replacement value, content loss, functional loss and displacement cost, from a Countywide 1%-annual-chance flood are estimated to be over $1 billion. In this scenario, an expected 669 buildings would be moderately damaged. In addition, an estimated 2,454 households, or 7,362 people, would be displaced, and nearly 200 people would require shelter. Essential facilities would largely remain undamaged in this scenario, but five fire stations and three police stations are estimated to have at least moderate damage. Of these facilities, five fire stations and two police station would experience some loss of use. For more details on the Hazus methodology used and additional results reports, see Appendix F.

Losses associated with natural hazard events are sometimes reported to the NCEI with the event. The reporting time frame is 1950-2019. While these historic losses give a glimpse of potential losses in hazard events, they are not reported for all events and should be considered a broad estimate. Several deaths and millions of dollars' worth of property

damage have been caused by floods, flash floods, or ice jams in Washington County. Previous flood events listed in Figure 4.3.3-3 have caused an estimated $14 million worth of property damage throughout the County from 1996-2021. It is important to note that loss estimates are not available for many of the previous flood events which have occurred in the County. Historical loss estimates are available for only 61 of the 102 events listed in Table 4.3.3-4.

Additionally, as discussed in Section 4.3.3.5 there are 2,789 structures in Washington County insured under the NFIP. A total of 938 NFIP claims for flood damages have been made since 1978 for these structures. Cumulative NFIP payments for flood damages have exceeded $15 million.

Below, Figure 4.4.3-1 shows Hazus modeled potential flood losses in Washington County. This model is consistent with other data found for flood risk in the County. The greatest losses are expected to be found in areas along the I-79 corridor, for example Cecil Township, Chartiers Township, Peters Township, and Cannonsburg Borough. However, due to the topography of Washington County, flood losses can be expected in every municipality.

Figure 4.4.3-1 Hazus Modeled Flood Loss in Washington County

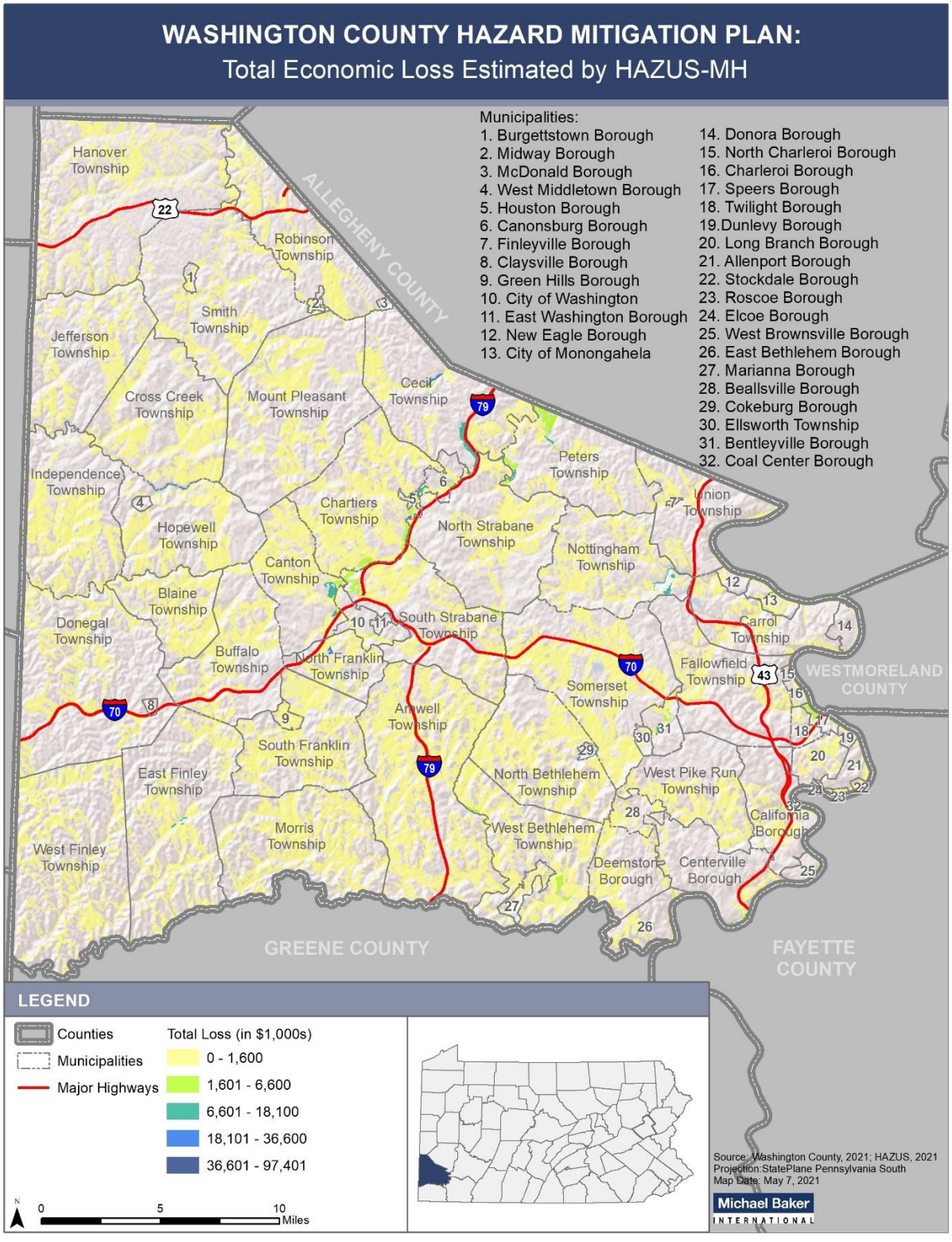
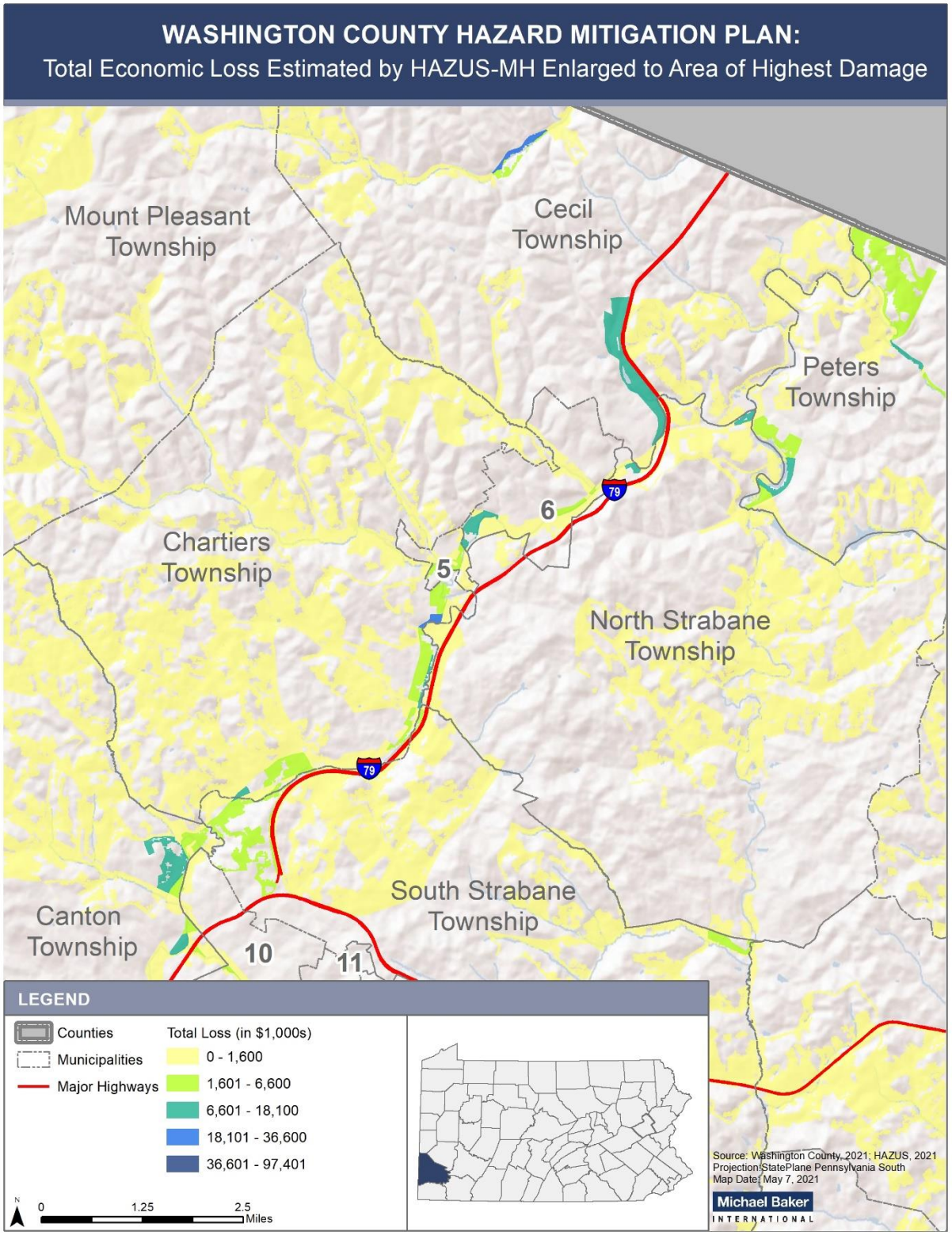


Figure 4.4.3-2 Hazus Modeled Flood Loss in Washington County Highest Damage Area Enlarged



4.4.4. Future Development and Vulnerability

Population change is perhaps the most significant indicator of changes in vulnerability and risk in the future. A rise or decrease in population not only impacts the level of risk (as to how many individuals could be affected), but also foreshadows development and land use changes for the County and its municipalities. Washington County is expected to experience a variety of factors that will, in some areas, increase vulnerability to hazards while in other areas, vulnerability may stay static or even be reduced. Much of this is dependent on future population and land use and development patterns.

Population projections are useful in determining if a given area's population trends will continue into the future. The PA DEP produces County and municipal population projections based on U.S. Census data from 2000 and 2010 to aid both County and municipality comprehensive planning. Projections developed for each of Washington County's municipalities are shown in Table 4.4.4-1. Bolded entries represent municipalities with greater than 25% projected population increase. It is worth noting that Green Hills Borough's population is expected to rise drastically but is still expected to remain small.

Table 4.4.4-1 Municipal 2010 Population and Population Projections (PA DEP 2014)

MUNICIPALITY	BASELINE POPULATION 2010 US CENSUS	POPULATION PROJECTIONS			PERCENT CHANGE, 2010-2040
		2020	2030	2040	
Allenport Borough	537	506	485	459	-14.50%
Amwell Township	3,751	3,538	3,327	3,115	-17.00%
Beallsville Borough	466	436	397	363	-22.10%
Bentleyville Borough	2,581	2,517	2,535	2,506	-2.90%
Blaine Township	690	681	731	747	8.30%
Buffalo Township	2,069	2,028	1,993	1,955	-5.50%
Burgettstown Borough	1,388	1,274	1,160	1,045	-24.70%
California Borough	**6,795**	**7,176**	**8,208**	**8,869**	**30.50%**
Canonsburg Borough	8,992	8,818	8,964	8,927	-0.70%
Canton Township	8,375	7,936	7,490	7,048	-15.80%
Carroll Township	5,640	5,320	5,161	4,910	-12.90%
Cecil Township	**11,271**	**12,382**	**13,724**	**14,934**	**32.50%**
Centerville Borough	3,263	2,969	2,771	2,518	-22.80%
Charleroi Borough	4,120	3,749	3,412	3,055	-25.80%
Chartiers Township	7,818	7,846	8,237	8,421	7.70%
Claysville Borough	829	754	782	752	-9.30%
Coal Center Borough	139	126	124	116	-16.50%
Cokeburg Borough	630	587	534	487	-22.70%

Table 4.4.4-1 Municipal 2010 Population and Population Projections (PA DEP 2014)					
Cross Creek Township	1,556	1,477	1,369	1,278	-17.90%
Deemston Borough	722	707	651	618	-14.40%
Donegal Township	2,465	2,527	2,575	2,631	6.70%
Donora Borough	4,781	4,351	3,959	3,545	-25.90%
Dunlevy Borough	381	363	346	328	-13.90%
East Bethlehem Township	2,354	2,142	1,949	1,746	-25.80%
East Finley Township	1,392	1,356	1,285	1,235	-11.30%
East Washington Borough	2,234	2,252	2,434	2,522	12.90%
Elco Borough	323	300	273	248	-23.20%
Ellsworth Borough	1,027	1,023	989	973	-5.30%
Fallowfield Township	4,321	3,969	3,738	3,438	-20.40%
Finleyville Borough	461	469	474	481	4.30%
Green Hills Borough	29	32	38	42	44.80%
Hanover Township	2,673	2,570	2,457	2,349	-12.10%
Hopewell Township	957	971	956	958	0.10%
Houston Borough	1,296	1,213	1,168	1,101	-15.00%
Independence Township	1,557	1,417	1,289	1,155	-25.80%
Jefferson Township	1,162	1,141	1,101	1,071	-7.80%
Long Branch Borough	447	440	401	380	-15.00%
Marianna Borough	494	450	409	366	-25.90%
McDonald Borough	1,766	1,756	1,694	1,662	-5.90%
Midway Borough	913	849	782	716	-21.60%
Monongahela, City of	4,300	4,007	3,646	3,324	-22.70%
Morris Township	1,105	1,106	1,006	964	-12.80%
Mount Pleasant Township	3,515	3,479	3,517	3,512	-0.10%
New Eagle Borough	2,184	2,202	2,165	2,160	-1.10%
North Bethlehem Township	1,631	1,512	1,395	1,277	-21.70%
North Charleroi Borough	1,313	1,195	1,087	974	-25.80%
North Franklin Township	4,583	4,380	4,159	3,948	-13.90%
North Strabane Township	13,408	15,774	18,558	21,103	57.40%
Nottingham Township	3,036	3,381	3,823	4,210	38.70%
Peters Township	21,213	24,547	28,060	31,470	48.40%
Robinson Township	1,931	1,838	1,672	1,548	-19.80%

Table 4.4.4-1 Municipal 2010 Population and Population Projections (PA DEP 2014)					
Roscoe Borough	812	783	750	719	-11.50%
Smith Township	4,476	4,279	4,142	3,971	-11.30%
Somerset Township	2,684	2,536	2,463	2,347	-12.60%
South Franklin Township	3,310	3,177	2,891	2,692	-18.70%
South Strabane Township	**9,346**	**10,106**	**11,208**	**12,115**	**29.60%**
Speers Borough	1,154	1,092	1,016	948	-17.90%
Stockdale Borough	502	457	416	372	-25.90%
Twilight Borough	233	223	215	205	-12.00%
Union Township	5,700	5,330	5,229	4,975	-12.70%
Washington, City of	13,663	12,635	11,497	10,422	-23.70%
West Bethlehem Township	1,460	1,373	1,352	1,293	-11.40%
West Brownsville Borough	992	903	821	736	-25.80%
West Finley Township	878	835	774	724	-17.50%
West Middletown Borough	139	126	118	108	-22.30%
West Pike Run Township	1,587	1,503	1,368	1,262	-20.50%
WASHINGTON COUNTY	**207,820**	**209,197**	**213,720**	**216,449**	**4.2%**

As shown in Table 4.4.4-1 the County is expecting a population loss in the boroughs and cities, with growth only expected in the townships. As a whole, the County is expected to slightly gain population, with 4.2% increase by 2040. The five fastest growing townships, according to DEP's projections, will be North Strabane, Peters, Nottingham, Cecil, and South Strabane townships.

Data for subdivision and land development plans is unavailable for the County. However, Pittsburgh Today, a group that analyzes the Pittsburgh region, includes Washington County in their analysis of new building permits between 2004 and 2013 for the region. The number of new building permits for Washington County has been on a decline since 2004 (the data was collected from the Census Bureau's building permit survey and the 2013 data was preliminary at the time). In 2004, the County had 1,004 new building permits, but by 2013, there were only 485 permits, this is a marked decline in new development and growth. Figure 4.4.4-2 displays the change in the number of new building permits for Washington County from 2004 to 2013.

Development can often change the hazard threat level of an area by placing additional critical facilities, businesses, transportation networks, and populations within vulnerable areas. Any development along transportation routes can increase the vulnerability to transportation

incidents and hazardous material spills. Most often, development occurs along these transportation networks because of access and increased demand for travel and access to services. Therefore, the impact of these hazards can increase along with their frequency. While it can be difficult to curb development, it is to the municipality's advantage to be aware of development trends in order to successfully mitigate future hazards as risks increase.

The 2005 Washington County Comprehensive Plan identifies an economic strategy for development of the County's resources within its borders, and as a part of the larger region, namely the Southwestern Pennsylvania Commission. In conjunction with the Comprehensive Plan, several additional plans layout a strategy for coordinating growth with preservation. The Greenways Plan of 2007 acts to ensure the documentation of the County's environmental resources, and to create guidelines for establishing a greenway network not only in the municipalities and County, but as a larger part of a statewide system. The County has also taken steps to ensure the preservation of agricultural lands, as of 2005, roughly 11% of the County's total land area (60,000 acres) was protected as agricultural security areas under the Agricultural Area Security Law of 1981. Finally, the Stormwater Management Plan of 2008 aims to identify the stresses to stormwater infrastructure that are created by continued growth and development. Combined, these plans begin to address the challenges inherent in future development and growth, and how they can be balanced and mitigated through planning measures, and as a result reduce potential vulnerability.

Since there has been a slight population increase and the number of new building permits has been in decline, it would be expected that vulnerability and risk would be unlikely to drastically increase in the future. However, there is one significant development change in Washington County that has occurred in the last five years, and is expected to continue – the natural gas industry (as well as conventional drilling). Though there is no data available data on the amount of additional development of late that has occurred due to (conventional and unconventional) drilling in Washington County, it can still be expected to be one of the most influential variables in Washington County's future vulnerability and risk.

The expansion of the natural gas industry in Washington County, as well continued growth in conventional drilling can have cumulative and longer-lasting environmental impacts, some of which aren't fully known. As explored in Section 4.3.8.4, 12% of the County was converted to impervious surface within the past five years, due to the natural gas industry alone. Additionally, this industry is spread across the entirety of the County, with most of the population in close proximity to a drilling site. This is a significant amount of development that affects flooding, transportation, as well as water supply, and larger environmental concerns.

When planning for future development, there are several measures the County could take to help mitigate the impacts of natural gas drilling on transportation infrastructure and impervious surfaces. If continued investment and development in the natural gas industry is inevitable, then how the County regulates new well pads siting locations and the industry as whole will become important in shaping Washington County's future vulnerabilities and risk,

greater care and oversight could be taken to balance future well development with watershed needs and conservation goals.

5. Capability Assessment

5.1. Update Process Summary

Washington County has a number of existing resources and future opportunities to implement hazard mitigation initiatives including emergency response measures, local planning and regulatory tools, administrative assistance and technical expertise, fiscal capabilities, and participation in local, regional, state, and federal programs. The presence of these resources enables community resiliency through actions taken before, during, and after a hazard event.

The 2015 HMP update included a capability assessment survey developed based on FEMA and PEMA guidance and shortened from the 2011 HMP capability assessment survey to collect the most essential capability information. The survey asked about the most common plans, tools, and programs found in Washington County communities; about staff and personnel resources; and ended with a self-assessment of capabilities. Municipalities were asked to complete the information to the best of their ability.

For the 2021 HMP update, the capability assessment survey was developed based on the most recent FEMA and PEMA guidance, and similar to the 2015 capability assessment survey asked about the common plans and programs, staff and personnel resources, and a self-assessment of capabilities. To augment municipal responses, the Washington County Planning Commission reviewed the information collected about land use, plans, and ordinances in each community.

To aid municipalities in completing the 2021 Capability Assessment Survey, a copy of their 2015 Capability Assessment Survey was provided if a survey was completed. If a municipality did not complete a survey for the 2015 HMP Update, they were provided with a blank survey. The Capability Assessment Survey was provided in an electronic format (via e-mail and the project website) to each municipality. In addition, Washington County Department of Public Safety and Washington County Planning Commission identified County-level capabilities.

The capability assessment is a good tool to identify local capabilities and to recognize gaps and weaknesses that can be addressed through future mitigation actions. The results of the capability assessment provide useful information for developing an effective mitigation strategy.

5.2. Capability Assessment Findings

Within Pennsylvania, no County-level capability assessment would be complete without considering the constituent municipalities. Local municipalities have their own governing body, enforce their own rules and regulations, purchase their own equipment, maintain their own infrastructure, and manage their own resources. In many ways, the County is only as good as the capabilities of its constituent municipalities. Therefore, the capability assessment does not consider Washington County as a lone entity but evaluates it considering the various characteristics and differences of and between its municipalities.

Washington County's 66 municipalities carry out daily operations and provide various community services according to local needs and limitations. Some of the municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide services such as police protection, fire and emergency response, wastewater treatment, water supply management, and planning, while others choose to operate independently. Washington County's municipalities vary in staff size, resource availability, fiscal status, service provision, municipal population, overall size, and vulnerability to the profiled hazards. More information on planning and emergency services cooperative agreements are in Section 5.2.1, and a list of shared water suppliers is in Section 4.3.1.

In general, Washington County municipalities with fewer residents usually have less staff resulting in limited supply of available resources compared to those municipalities with a greater number of residents. Therefore, areas with limited resources to address hazard mitigation may require a more unified or coordinated approach and/or more efficient utilization of a limited supply of available resources (i.e., financial, technical, and human).

5.2.1. Planning and Regulatory Capability

Pennsylvania municipalities have the authority to govern more restrictively than state and federal minimum requirements provided they comply with criteria established in the Pennsylvania Municipalities Planning Code (MPC). Municipalities can develop their own policies and programs and implement their own rules and regulations to protect and serve their local residents. Washington County and municipalities have used, and could continue to use, planning and regulatory tools to support the goals of this hazard mitigation plan and to provide opportunities for further mitigating the potentially negative effects of hazards.

Municipalities implement land use controls via the adoption and enforcement of zoning, subdivision and land development ordinances, building codes, building permit ordinances, floodplain, and stormwater management ordinances. When effectively prepared and administered, these regulations can lead to hazard mitigation. For example, the adoption of the NFIP and the Pennsylvania Floodplain Management Act (Act 166 of 1978) established minimum floodplain management criteria. A municipality must adopt and enforce these minimum criteria to be eligible for participation in the NFIP. Municipalities have the option of adopting a single-purpose ordinance or incorporating these provisions into their zoning and/or subdivision and land development ordinances, or building codes, thereby mitigating the potential impacts of local flooding.

Plans and Regulations

The subsections below provide details on the types of major plans and ordinances that Washington County and local municipalities use to support the goals of this hazard mitigation plan and provide opportunities for further mitigating the potentially negative effects of natural hazards through regulation.

Commonwealth of Pennsylvania Document Review

The 2018 Update of the Pennsylvania State All-Hazard Mitigation Plan has goals and objectives that are applicable to this Washington County Plan Update including:

- 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 for Washington County has been incorporated into the appropriate sections of this plan update from the 2018 PA All-Hazard Mitigation Plan.

The Uniform Construction Code (UCC) is the statewide building code (Act 45 of 1999) that took effect in Pennsylvania in April of 2004. 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 the Pennsylvania Emergency Management Agency. One of the most significant outcomes of PEMA's participation on the team is the integration of hazard mitigation goals and objectives into the comprehensive land use planning process.

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.

Regional/County Document Review

The Washington County Comprehensive Plan was completed and adopted in 2005. A comprehensive plan is a policy document identifying community goals and objectives for future growth and development with an emphasis on how and at what pace the County will develop. In Washington County, this is the policy basis for zoning decisions and other land development policies Countywide.

The Comprehensive Plan is a blueprint for housing, transportation, community facilities, utilities, and land use. It examines how the past led to the present and charts the community's future path. Pennsylvania's MPC (Act 247 of 1968), as reauthorized and amended, requires counties to prepare and maintain a County comprehensive plan and to update it every 10 years. In addition to the County Comprehensive Plan, 53 of the 66 municipalities have an adopted or in progress municipal comprehensive plan, as shown in Table 5.2-1.

The update of the Washington County Comprehensive Plan kicked off in early 2021. Having representatives from the Washington County Planning Commission on the HMSC ensured information pertinent to both plans was incorporated into the discussion and decisions. The data collected and mitigation strategy of the HMP will be incorporated into the discussion decisions made throughout the Comprehensive Plan update. As of September 2021, the stakeholder focus group meetings have been held, and information collected is being compiled.

There is also the Multi-Municipal Comprehensive Plan for Mon Valley Communities (2017) that is facilitated through the Redevelopment Authority of Washington County. Hopewell Township and West Middletown Boroughs also participate in a multi-municipal comprehensive plan (2013). West Finley Township noted the need to update its outdated comprehensive plan. Smith Township adopted a comprehensive plan in 2002, and North Franklin adopted its plan in 2013. North Strabane Township's plan was finalized in 2016 and addresses hazards throughout the Township and effectively reduces development in known hazard locations. South Strabane Township's plan was finalized in 2017 and will be updated in 2027.

The City of Washington and East Washington Borough have a Multi-Municipal Comprehensive Plan. Chapter two highlights land use regarding floodplains and topography guidance within additional documents relating to mitigating floodplain areas. One key objective is to address stormwater issues in project areas, implement previous planning efforts, adopt county model ordinance, and educate the public and partner with local entities for improvements.

Mount Pleasant Township also has a 2015-2025 Comprehensive Plan, focusing on stormwater, that will be updated in 2025. Finleyville and Nottingham Township implement a multi-municipal plan, dated July 2010, to address floodplains and to educate residents on the NFIP and floodplain ordinance. Cecil Township's plan is dated 1998, but efforts did start in 2019 to update the plan. West Pike Run Township's plan was updated in 2016 and includes a natural resource protection section.

Plan Peters 2022, completed by the Township in 2013, outlines zoning restrictions for residential and commercial buildings regarding floodplains. Physical improvements to streets, streetscape and entryways, sidewalks, parks, and public facilities are recommended to achieve an establish vision and goals. This document is referenced as a basis for zoning ordinance amendments to support the plan's goals.

Washington County also has a Greenways Plan, adopted January 2007 as an amendment to the comprehensive plan to proactively balance development and preservation of green space.

The Northwest Washington County Corridor Based Transportation Plan was completed in 2019 and evaluates corridors and intersections within the I-79, PA 19 corridor to identify short, medium, and long-term multimodal improvements. This area, south of Allegheny County, is the focus of long range development and the future home of the Pennsylvania Turnpike Commission's Southern Beltway project that connects the Pittsburgh Airport to the I-79 corridor which will contribute to an estimated 30% growth in projected traffic over the next 20 years.

The Washington County Parks, Recreation, and Open Space Master Plan, 2014, is an update of the Parks, Recreation and Open Space Master Plan which was developed in 2000. This update provides a comprehensive series of physical recommendations in support of ecology, history, programs/events, activities, and behaviors for Mingo Creek and Cross Creek County Parks. This plan looks at land resources and identifies areas offering opportunities for preserving and protecting natural resources.

The Washington County Transit Development Plan, 2018, is part of a regional effort by the Southwest Pennsylvania Commission to improve public transportation throughout the region.

Municipalities can help regulate construction in floodplains through floodplain ordinances and floodplain management plans. Floodplain management plans describe how the community will reduce the impact of flood events through preventive and corrective actions. Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures located in a floodplain are flood-proofed, dry-proofed, or built above anticipated flood elevations. The NFIP establishes minimum ordinance requirements which must be met for that community to participate in the program.

Buffalo Township is currently updating Floodplain Ordinance No. 76 and Amendment No. 77 via its zoning officer, who is also the floodplain administrator. Fallowfield Township's Ordinance No. 220 was put into effect in August 2015, and Hanover Township's No. 132 was put into effect in September 2015. Burgettstown Borough also uses its floodplain management plan to prevent development in the floodplain. Canton Township enforces its ordinance to encourage appropriate construction practices minimize flood damage and minimize danger to public safety. North Franklin Township's floodplain ordinance was adopted in September 2015.

The City of Washington's flood damage prevention is an ordinance pertaining to areas within the NFIP study for floodway and floodplain. It provides guidance elating to what type of building is allowed, size and location of first floor elevations, and how to submit for construction within the boundary lines. The ordinance it utilized anytime someone either has construction within the designated floodplain or when a greater than 50% improvement is

made to an existing structure within the floodplain. It is administered by the Flood Plain Administrative with the assist of the Fire Department and the consulting City Engineer.

Local Document Review

Beyond the County and municipal comprehensive plans, there are a number of key land development ordinances intended to enable orderly growth and development. Zoning ordinances specify the type and intensity of development that occur in particular locations and directly affects land use patterns. Of the 66 municipalities, 58 have enacted a local zoning ordinance. The local municipalities are responsible for reviewing all development applications for concurrency with local zoning regulations.

Subdivision and land development ordinances (SALDOs) 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. A total of 51 of the 66 municipalities in Washington County have a SALDO in place. Like zoning ordinances, SALDO regulations are administered at the local level, but the Washington County Planning Commission reviews subdivision applications with particular attention paid to whether there is a chance that the property will be affected by landslides, presence of wetlands, flooding, mine subsidence, and natural heritage areas.

Canton Township implements hazard mitigation through its SALDO to prohibit development in the floodplain and to maintain public safety from landslides with appropriate setbacks. East Washington Borough has a joint zoning ordinance with the City of Washington, as of 2015. North Franklin Township adopted its zoning regulations in September 2016, and its subdivision regulations in May 1997.

The proper management of stormwater runoff can improve conditions and decrease the chance of flooding. The Pennsylvania legislature enacted the Stormwater Management Act (Act 167 if 1978), commonly called Act 167, requiring counties to develop stormwater management plans for designated watersheds. This planning effort results in sound engineering standards and criteria being incorporated into local codes and ordinances to manage stormwater runoff from new development in a coordinated, watershed-wide approach. Without such planning, stormwater is either not controlled by municipal ordinances, or is addressed on a site-by-site or municipal boundary basis. Municipalities within the same watershed may require different levels of stormwater control. The result is often the total disregard of downstream impacts or the compounding of existing flooding problems.

Act 167 Stormwater Management Plans are intended to improve stormwater management practices, mitigate potential negative impacts from future land uses, and 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. Also, it is not the intent of this plan to solve existing

flooding or runoff problems, but to identify for future correction and assure problems do not get worse. More specifically, this plan does not require municipalities to correct existing drainage problems.

Washington County adopted Phase I of its Act 167 stormwater management plan in 2008 and Phase II in 2010. The County Stormwater Management Plan is a policy document to manage stormwater runoff; together with its accompanying model ordinance, this planning and regulatory effort will ensure that water quality will not worsen with future growth. The key provisions of the Stormwater Management Model Ordinance are the development of riparian buffer standards and optional Existing Resources and Site Analysis specifications for special protection watersheds.

Municipal adoption of the Stormwater Management Plan and Model Ordinance stands at 36 of 66 municipalities, or just over half. Buffalo Township noted Stormwater Management Ordinance No. 59 is currently being updated via the codification process. Canton Township's MS4 reduces flooding in vulnerable areas with various mitigation controls. The City of Washington's stormwater ordinance was put into effect on July 9, 2015 with riparian buffer standards and low impact development practices being particularly integral in hazard mitigation. South Strabane Township has a stormwater management plan dated in 2012 and plans to update it in 2023 per the MS4 permit cycle. Cecil Township also has a stormwater management plan through its contracted engineers. North Franklin Township's stormwater management plan was finalized in 2011.

Building codes are important in hazard mitigation as codes are developed specific to hazards present within a given region of the country. Consequently, structures are constructed to applicable codes developed for resistance to many hazards such as strong winds, floods, and earthquakes, and can also help mitigate regional hazards like wildfires. In 2003, the Commonwealth implemented the Uniform Construction Code (UCC) (Act 45 of 1999), a comprehensive building code that establishes minimum regulations for most new construction, including additions and renovations to existing structures.

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

All but seven Washington County communities are opt-in municipalities; Beallsville, Cokeburg, Ellsworth, Green Hills, New Eagle, Twilight, and West Middletown Boroughs are the opt-out municipalities. Buffalo Township noted Permit Ordinance No. 41 and 42 are currently being updated via the codification process. Burgettstown Borough updates its building code as needs arise to address structures in poor condition. East Washington Borough also highlighted having the property maintenance, rental registration, and international property

maintenance code 2018 in place. Peters Township maintains a building code of ordinances (March 2016) applicable to residences and businesses of the Township.

Table 5.2-1 is an overview of local plans and regulations including updates collected during the 2021 HMP process.

Table 5.2-1 Summary of Major Plans and Regulations in Washington County

MUNICIPALITY	COMPREHENSIVE LAND USE PLAN	NFIP/FP REGULATIONS	SUBDIVISION REGULATIONS	ZONING REGULATIONS	STORMWATER MANAGEMENT PLAN AND ORDINANCE	UNIFORM CONSTRUCTION CODE OPT-IN
Allenport Borough	X	X	X	X		X
Amwell Township		X	X	X	X	X
Beallsville Borough		X			X	
Bentleyville Borough	X	X	X	X		X
Blaine Township	X	X	X	X	X	X
Buffalo Township		X	X	X	X	X
Burgettstown Borough		X	X	X	X	X
California Borough	X	X	X	X	X	X
Canonsburg Borough	X	X	X	X	X	X
Canton Township	X	X	X	X		X
Carroll Township	X	X	X	X	X	X
Cecil Township	X	X	X	X		X
Centerville Borough	X	X	X	X	X	X
Charleroi Borough		X	X	X	X	X
Chartiers Township	X	X	X	X	X	X
Claysville Borough	X	N/A, not in NFIP (never mapped)		X	X	X
Coal Center Borough	X	X	X	X	X	X
Cokeburg Borough		N/A, not in NFIP (never mapped)	X	X	X	
Cross Creek Township	X	X	X	X		X
Deemston Borough	X	X				X
Donegal Township	X	X	X			X

Table 5.2-1 Summary of Major Plans and Regulations in Washington County						
MUNICIPALITY	COMPREHENSIVE LAND USE PLAN	NFIP/FP REGULATIONS	SUBDIVISION REGULATIONS	ZONING REGULATIONS	STORMWATER MANAGEMENT PLAN AND ORDINANCE	UNIFORM CONSTRUCTION CODE OPT-IN
Donora Borough		X	X	X		X
Dunlevy Borough	X	X	X	X	X	X
East Bethlehem Township	X	X	X	X		X
East Finley Township		X		X	X	X
East Washington Borough	X	X	X	X	X	X
Elco Borough	X	X	X	X		X
Ellsworth Borough		X		X	X	
Fallowfield Township		X	X	X	X	X
Finleyville Borough	X	X			X	X
Green Hills Borough	X	N/A, not in NFIP (never mapped)	X	X		
Hanover Township	X	X	X	X		X
Hopewell Township	X	X	X	X		X
Houston Borough	X	X	X	X	X	X
Independence Township	X		X	X	X	X
Jefferson Township	X	X	X	X		X
Long Branch Borough		X	X	X		X
Marianna Borough	X	X	X		X	X
McDonald Borough	X	X	X	X	X	X
Midway Borough	X	X	X	X	X	X
Monongahela, City of	X	X	X	X		X
Morris Township		X	X	X	X	X
Mount Pleasant Township	X	X	X	X		X
New Eagle Borough	X	X	X			

Table 5.2-1 Summary of Major Plans and Regulations in Washington County						
MUNICIPALITY	COMPREHENSIVE LAND USE PLAN	NFIP/FP REGULATIONS	SUBDIVISION REGULATIONS	ZONING REGULATIONS	STORMWATER MANAGEMENT PLAN AND ORDINANCE	UNIFORM CONSTRUCTION CODE OPT-IN
North Bethlehem Township		X	X			X
North Charleroi Borough	I	X		X		X
North Franklin Township	X	X	X	X	X	X
North Strabane Township	X	X	X	X	X	X
Nottingham Township	X	X	X	X	X	X
Peters Township	X	X	X	X	X	X
Robinson Township	X	X	X	X	X	X
Roscoe Borough	X	X	X	X	X	X
Smith Township	X	X	X	X		X
Somerset Township	X	X	X	X		X
South Franklin Township	X	X	X	X		X
South Strabane Township	X	X	X	X	X	X
Speers Borough		X	X	X	X	X
Stockdale Borough	X	X	X	X	X	X
Twilight Borough		X	X	X	X	
Union Township	X	X	X	X	X	X
Washington, City of	X	X	X	X		X
West Bethlehem Township	In Development (with Marianna Borough)	X			X	X
West Brownsville Borough	X	X	X	X	X	X
West Finley Township		X	X			X

Table 5.2-1 Summary of Major Plans and Regulations in Washington County						
MUNICIPALITY	COMPREHENSIVE LAND USE PLAN	NFIP/FP REGULATIONS	SUBDIVISION REGULATIONS	ZONING REGULATIONS	STORMWATER MANAGEMENT PLAN AND ORDINANCE	UNIFORM CONSTRUCTION CODE OPT-IN
West Middletown Borough	X	N/A, not in NFIP (never mapped)		X		
West Pike Run Township	X	X	X	X		X

Emergency Management

In Washington County emergency management is a comprehensive, integrated program of mitigation, preparedness, response, and recovery for all types of emergencies and disasters. In Pennsylvania, Emergency Management begins at the municipal level, as required by the PA Emergency Management Service Code. Every county, city, borough, and township in the Commonwealth is required to have an emergency management coordinator selected by the elected officials of the jurisdiction. The ultimate responsibility for Emergency Management always rests with the chief elected officials and governing body; however, the Emergency Management Coordinator's role is to develop plans, conduct training, and coordinate all available resources in the community pre- and post-disaster.

South Franklin Township noted that its volunteer fire department is not getting the same number of volunteers. It does work with other townships to support each other, but it is not as sustainable. Similarly, North Franklin Township disbanded their police department (years ago), and the regional police department was cost prohibitive. South Franklin Township added a mitigation action to track fire department gaps and look for partnering opportunities.

Participation in the National Flood Insurance Program and the Community Rating System

National Flood Insurance Program (NFIP)

The Pennsylvania Floodplain Management Act (Act 166 of 1978) requires every municipality with flood hazard areas identified by the Federal Emergency Management Agency (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.

Of the municipalities in Washington County, 60 of 66 participate in the NFIP. Two municipalities were suspended: Long Branch Borough and North Bethlehem Township. Four municipalities have no SFHAs and have never been mapped: Claysville Borough, Cokeburg Borough, Green Hills Borough, and West Alexander Borough.

Throughout the planning process stakeholders were asked to complete an NFIP Survey. The information received in the completed surveys indicated that municipalities participating in the NFIP follow the regulations set forth by the NFIP.

Table 5.2.1-1 shows whether the municipality is participating in NFIP, the number of policies they have, whether the municipality is in good standing, and when they entered the NFIP. Long Branch Borough, North Bethlehem Township, West Alexander Borough, Claysville Borough, Cokeburg Borough, and Green Hills Borough do not participate in the NFIP.

Table 5.2.1-1 NFIP Participation in Washington County (FEMA CIS 2020)

MUNICIPALITY	DATE ENTERED THE NFIP	# POLICIES	IS THE COMMUNITY IN GOOD STANDING?
Allenport Borough	07/16/1981	35	Yes
Amwell Township	09/15/1989	11	Yes
Beallsville Borough	09/24/1984	0	Yes
Bentleyville Borough	06/17/1986	2	Yes
Blaine Township	07/02/1982	1	Yes
Buffalo Township	06/11/1982	3	Yes
Burgettstown Borough	02/17/1989	8	Yes
California Borough	06/15/1981	32	Yes
Canonsburg Borough	04/01/1980	14	Yes
Canton Township	11/05/1986	21	Yes
Carroll Township	03/18/1980	15	Yes
Cecil Township	09/05/1979	27	Yes
Centerville Borough	06/15/1981	20	Yes
Charleroi Borough	07/16/1981	11	Yes
Chartiers Township	02/01/1980	31	Yes
Claysville Borough	Not Participating	Not Participating	Not Participating
Coal Center Borough	09/30/1981	9	Yes
Cokeburg Borough	Not Participating	Not Participating	Not Participating
Cross Creek Township	02/01/1987	7	Yes
Deemston Borough	05/01/1985	1	Yes
Donegal Township	10/15/1982	0	Yes
Donora Borough	09/30/1995	1	Yes
Dunlevy Borough	07/16/1981	4	Yes
East Bethlehem Township	07/16/1981	29	Yes
East Finley Township	05/01/1985	4	Yes
East Washington Borough	09/30/2015	2	Yes

Table 5.2.1-1 NFIP Participation in Washington County (FEMA CIS 2020)			
MUNICIPALITY	DATE ENTERED THE NFIP	# POLICIES	IS THE COMMUNITY IN GOOD STANDING?
Elco Borough	07/16/1981	13	Yes
Ellsworth Borough	09/10/1984	0	Yes
Fallowfield Township	02/17/1989	9	Yes
Finleyville Borough	09/01/1986	2	Yes
Green Hills Borough	Not Participating	Not Participating	Not Participating
Hanover Township	09/24/1984	4	Yes
Hopewell Township	08/06/1982	1	Yes
Houston Borough	12/18/1979	34	Yes
Independence Township	02/01/1987	4	Yes
Jefferson Township	06/30/1976	0	Yes
Long Branch Borough	09/01/1986	0	No
Marianna Borough	06/19/1989	0	Yes
Midway Borough	08/15/1989	9	Yes
City of Monongahela	07/03/1986	33	Yes
Morris Township	08/05/1985	1	Yes
Mount Pleasant Township	10/08/1982	4	Yes
New Eagle Borough	03/18/1980	1	Yes
North Bethlehem Township	10/15/1985	0	No
North Charleroi Borough	07/16/1981	8	Yes
North Franklin Township	07/04/1989	13	Yes
North Strabane Township	02/15/1980	14	Yes
Nottingham Township	09/10/1984	8	Yes
Peters Township	11/01/1979	50	Yes
Robinson Township	02/25/1983	1	Yes
Roscoe Borough	07/16/1981	64	Yes
Smith Township	07/01/1986	12	Yes
Somerset Township	07/01/1986	3	Yes
South Franklin Township	07/17/1989	15	Yes
South Strabane Township	04/15/1980	13	Yes
Speers Borough	07/16/1981	11	Yes
Stockdale Borough	07/16/1981	30	Yes
Twilight Borough	09/28/1979	1	Yes
Union Township	02/02/1977	20	Yes
City of Washington	11/05/1986	52	Yes
West Alexander Borough	Not Participating	Not Participating	Not Participating
West Bethlehem Township	09/01/1986	7	
West Brownsville Borough	04/27/1973	19	Yes
West Finley Township	09/24/1984	1	Yes

Table 5.2.1-1 NFIP Participation in Washington County (FEMA CIS 2020)			
MUNICIPALITY	DATE ENTERED THE NFIP	# POLICIES	IS THE COMMUNITY IN GOOD STANDING?
West Middletown Borough	09/30/2015	0	Yes
West Pike Run Township	09/01/1986	4	Yes
TOTAL		6,147	

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 exceeds the minimum NFIP requirements. All NFIP participating communities in Washington County have either adopted a stand-alone ordinance or have arranged for County administration of floodplain regulations.

Community Rating System (CRS)

The NFIP's CRS provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Under the CRS, communities receive credit for more restrictive regulations; acquisition; relocation, or flood-proofing of flood-prone buildings, preservation of open space; and other measures that reduce flood damage or protect the natural resources and functions of floodplains.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the 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 the 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.

Washington County does not have any participating communities in the CRS. However, recognizing the benefits of program participation, action 10 in the Mitigation Action Plan seeks to encourage CRS participation through training for municipal officials.

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 (i.e. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with the education or expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, fiscal staff to handle complex grant application processes.

Based on assessment results, Washington County municipalities have moderate levels of administrative and technical staff needed to conduct hazard mitigation-activities. There appear to be sufficient emergency management and land use planning staff across the County.

Engineering

Engineering and building and code officers are typically contracted as needed by most municipalities such as the City of Washington, Canton, Hanover, Hopewell, Jefferson, Independence, Mount Pleasant, Nottingham, North Franklin, North Strabane, Smith, South Strabane, West Finley, West Pike Run, and Buffalo Townships and Burgettstown, Beallsville, and Marianna Boroughs. Officers typically review plans, construction projects, and compliance activities. They also make recommendations relating to specific hazard mitigation requirements per the existing ordinances. Canton, Cecil, Nottingham, North Strabane, South Strabane, and Fallowfield Townships' code enforcement and building officer is held by the same person and is a full-time position. Peters Township has an Engineering Department to handle construction projects, road paving, stormwater management, and is the liaison between the local Sanitary Authorities.

East Washington Borough's contracted engineers meet monthly with the Mayor and Council to discuss any projects or updates throughout the month and also any concerns or actions required. The code enforcement department handles property maintenance complaints and the rental registration ordinance and inspections along with the contracted engineering. The chief building officer for the Borough handles all training and assists in building damage assessment along with the contracted engineers. The City of Washington's full-time code enforcement officer responds to complaints within city limits and addresses notices, violations, and corrective actions. He also performs on-site visits and recommends actions to entities to mitigate concerns. Claysville Borough only noted having a building officer in place.

County Administrative and Technical Capabilities

A variety of administrative capabilities are established in Washington County and its jurisdictions. These capabilities can support the implementation of mitigation actions that are proposed in this plan. These capabilities are:

- The Washington County Planning Commission is a significant source of administrative and technical assistance. The purpose of the Washington County Planning Commission has a variety of responsibilities that include mapping of the County, the review of land development and subdivisions, and the orderly development of land. The commission also maintains extensive population and demographic data for the County and provides comprehensive information to potential developers and the general public.

  The Planning Commission conducts and prepares numerous studies regarding environmental, economic, and general issues that impact County development and natural resources of the County. The commission also coordinates the development and preparation of various public affairs, information, and educational programs concerning County government. The Bridge Department, Department of Parks and Recreation, and flood control projects all fall under the Planning Commission's jurisdiction.
- Municipal Planning Commissions: In Pennsylvania planning responsibilities traditionally have been delegated to each County and local municipality through the municipal planning commission (MPC). The MPC conveys the planning authority and establishes the requirements that a municipality must follow. Thirty-one municipalities indicated that they have planners with appropriate knowledge of land development and management practices. In addition, 28 of the municipalities responding to the capability assessment indicated that they have such capabilities.

  Although some individual municipalities do not have a staff member with an understanding of hazards (natural or otherwise), the County Planning Commission will provide consultation in many facets of planning. Peters Township is one municipality noting its own planning department to address mitigation actions daily by reviewing new construction plans, conducting inspections, and issuing occupancy permits.

The County's Department of Public Safety functions in much the same way. In addition, all 66 municipalities in Washington County have EMCs. It is not uncommon that one EMC covers multiple municipal jurisdictions.

- Floodplain Managers are experts in the rules and regulations of development in a floodplain and can provide vast amounts of information on the risks and impacts of building within those hazard areas. They are an integral part of the mitigation planning team and can make recommendations based on the needs and conditions of the community. The 60 municipalities participating in the NFIP have a designated Floodplain Manager.
- GIS Support: Spatial and tabular data are linked in a computerized, visual format through the use of sophisticated GIS technology. Through GIS projects, it is possible to accomplish environmental restoration, economic development, Smart Growth land use planning, infrastructure development, and training to use GIS for decision support. Washington County has GIS capabilities that can assist the municipalities.

State Agencies

State agencies which can provide technical assistance for mitigation activities 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, and
- Pennsylvania Department of Transportation.

Federal Agencies

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

- Army Corp of Engineers,
- Department of Housing and Urban Development,
- Department of Agriculture,
- Economic Development Administration,
- Emergency Management Institute,
- Environmental Protection Agency,
- FEMA, and
- The Small Business Administration.

In 2005, Washington County was certified as a StormReady Community by the National Weather Service. 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 the National Weather Service in

partnership with Federal, State, and local emergency management professionals. The certification also makes Washington County and its municipalities eligible for 25 points in the Community Rating System, awarded to local governments that meet the flood threat recognition system.

5.2.3. Financial Capability

Financial capability is important to the implementation of hazard mitigation activities. Every jurisdiction must operate within the constraints of limited financial resources. During the 1960s and 1970s, state and federal grants-in-aid were available to finance many programs, including street improvements, water and sewer facilities, airports, and parks and playgrounds. During the early 1980s, there was a significant change in federal policy, based on rising deficits and a political philosophy that encouraged states and local governments to raise their own revenues for capital programs, resulting in the need to identify alternate means to augment revenue. After the COVID-19 pandemic, communities across the country will face new challenges in balancing community economic recovery while also implementing hazard mitigation.

A critical key 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 take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on the assessment results received, most municipalities within the County perceive fiscal capability to be limited; however, several communities listed their capability to be moderate.

Capital Improvement Program

The most common fiscal tool available to communities is the Capital Improvement Program (CIP). A CIP is a community planning and fiscal management tool used to coordinate the timing and financing of capital improvements over a multi-year period. A CIP includes a prioritized list of improvements to roads, parks, and other facilities that the community plans to undertake in a given period.

Of the 25 capability assessment surveys submitted, Canton Township, Cecil Township, City of Monongahela, Fallowfield Township, Hanover Township, Hopewell Township, Peters Township, Independence Township, North Strabane Township, and South Strabane Township noted having a CIP in place. The City of Washington uses a stormwater fund to address the City's MS4 program which includes a pollution reduction plan. Additionally, funds are used to address safety hazards relating to damaged facilities from stormwater, including piping, inlets, and manholes. Peters Township's CIP 2021-2026 funds have been used for multiple stormwater management projects.

Impact Fees from Unconventional Gas Drilling

The Pennsylvania Act 13 Impact Fee funded through unconventional oil and gas well drilling activities provides a fiscal mechanism available to Pennsylvania communities. The Oil and Gas Act (Act 13 of 2012) presented major changes to the oil and gas industry in Pennsylvania, including the authorization for local governments to adopt an impact fee and the provision of stronger environmental protections. The impact fees are allocated to County conservation districts, the Pennsylvania Fish and Boat Commission, the Pennsylvania Public Utility Commission, the Pennsylvania Department of Environmental Protection, the PEMA, the Pennsylvania Office of State Fire Commissioner, and the Pennsylvania Department of Transportation to address statewide issues. A portion of the impact fees are also allocated to local municipalities to address water, wastewater, and road infrastructure maintenance and improvements; emergency preparedness; environmental programs; tax reductions; increased safe/affordable housing; employee training; or planning initiatives.

The disbursement amount fluctuates based on well drilling activity. In 2019 a total of $251.8 million in Act 13 impact fees were disbursed throughout Pennsylvania. Of that amount, over $10.3 million was dispersed to 34 of Washington County's municipalities.

Community Development Block Grants

Washington County is also eligible for Community Development Block Grant (CDBG) funding from the US Department of Housing and Urban Development (HUD). The program is designed to assist vulnerable populations within the community by ensuring affordable housing, creating jobs, and providing direct services. The amount of each grant is determined by a formula that accounts for the community's need, poverty, population, housing, and comparison to other areas. The annual appropriation is divided among the states and local jurisdictions (referred to as "non-entitlement communities" and "entitlement communities"). The majority of CDBG funds are required to be spent to benefit low- and moderate-income citizens. Jefferson Township specifically noted the Township supervisors are responsible for coordinating HUD funding.

Water and Sewer Authority Fees

Water authorities are multi-purpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to a municipality is among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage. The cost of constructing or extending water supply lines can be funded by special assessments against abutting property owners. Tapping fees also help fund water system capital costs. Water utilities are directly operated by municipal governments and by privately owned public utilities regulated by the Pennsylvania Public Utility Commission (PUC). The Commonwealth Financing Authority, through DCED, operates the PA Small Water and Sewer Program with consolidation of small individual water systems to make system upgrades more cost effective.

Sewer authorities include multipurpose authorities with sewer projects. The authorities issue bonds to finance acquisition of existing systems or to finance construction, extension, and improvements. Sewer authority operating revenues originate from user fees. The fee frequently is based on the amount of water consumed, and payment is enforced by the ability to terminate service or the imposition of liens against real estate.

Buffalo Township has a utility fee for hydrants and street light assessments for specific parcels to reimburse Township costs. East Washington Borough levies fees for infrastructure work.

State and Federal Financial Resources and Grant Programs

The decision and capacity to implement mitigation-related activities is often strongly dependent on availability of local financial resources. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to leverage state or federal mitigation grant funding opportunities that require local-match contributions.

Most municipalities do not have an experienced grant writer on staff and must contract resources as needed. In most instances, such as Jefferson and Canton Townships, it's all-hands from the entire municipal team to pull resources together. East Washington and Marianna Boroughs and Independence Township have access to grant writers as needed. Buffalo Township's secretary/treasurer and North Strabane Township's manager take on the role for grant writing. The assistant township manager of Cecil Township also has grant writing experience. South Strabane Township has a financial analyst full-time responsible for grant writing. North Franklin Township's Director of Planning & Development is the grant writing lead, along with the Treasurer. Hopewell and West Pike Run Townships will contract grant writing, but also has some experience with the Board Supervisor and Secretary. Claysville Borough and Mount Pleasant, Nottingham, and Smith Townships noted not having access to a grant writer.

State funding sources that may be available for hazard mitigation planning activities at the time the HMP update was prepared include but are not limited to the following (DCED, 2020).

- CFA/DCED Abandoned Mine Drainage Abatement and Treatment Program
- CFA/DCED Baseline Water Quality Data Program
- CFA/DCED First Industries Fund
- CFA/DCED Flood Mitigation Program
- CFA/DCED H2O PA Flood Control Projects
- CFA/DCED H2O PA High Hazard Unsafe Dam Projects
- CFA/DCED H2O PA Water Supply, Sanitary Sewer and Storm Water Projects
- CFA/DCED Orphan or Abandoned Well Plugging Program
- CFA/DCED PA Small Water and Sewer
- CFA/DCED Sewage Facilities Program
- CFA/DCED Watershed Restoration Protection Program

- DCED Business Financing Programs
- DCED Keystone Communities Program
- DCED Local Government Capital Project Loan Program
- DCED Municipal Assistance Program
- DCED/DEP Coal Refuse Energy and Reclamation Tax Credit Program
- DCED/DEP Private Dam Financial Assurance Program
- DCNR Community Conservation Partnerships Program
- DEP Growing Greener Plus Grants Program
- PennDOT Pennsylvania Infrastructure Bank (PIB) Loan
- Pennsylvania Infrastructure Investment Authority (PENNVEST)
- Pennsylvania Redevelopment Assistance Capital Program (RACP)

Federal funding sources that may be available for hazard mitigation planning activities at the time the HMP update was prepared include but are not limited to the following.

- Appalachian Regional Commission (ARC) POWER Initiative Grant Program
- Department of Commerce (DOC)/Economic Development Authority (EDA) Construction Grant Program
- EDA Construction Grant Post Approval Process Tool for Grant Recipients (Version 5.0)
- https://www.eda.gov/tools/grantee-information/
- Department of Energy Weatherization Assistance Program
- Department of Homeland Security Grant Program (HSGP)
- Department of Transportation/Federal Highway Administration Emergency Relief Program
- DOC/EDA Planning Grants
- DOC/EDA Technical Assistance Grants FY 2016 – FY 2019 EDA PLANNING PROGRAM AND LOCAL TECHNICAL ASSISTANCE PROGRAM
- DOC/EDA Revolving Loan Fund (ACEDC RLF recipient)
- FEMA Community Assistance Program – State Support Services Element (CAP-SSSE)
- FEMA Community Disaster Loan Program
- FEMA NFIP Community Rating System
- FEMA Emergency Management Performance Grants (EMPG)
- FEMA Environmental Planning and Historic Preservation Program (EHP)
- FEMA Flood Mitigation Assistance Program
- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Individuals and Households Program (IHP)
- FEMA National Dam Safety Program
- FEMA National Flood Insurance Program
- FEMA Pre-Disaster Mitigation Program (PDM)
- FEMA Public Assistance Program (PA)
- FEMA Regional Catastrophic Preparedness Grant Program

- Housing and Urban Development (HUD) 5(H) Homeownership Program
- HUD Community Development Block Grant (CDBG)
- HUD Disaster Housing Assistance Program (DHAP)
- HUD/Federal Housing Administration (FHA) Title I Property Improvement Loans
- HUD/FHA Section 203(h) Mortgage Insurance for Disaster Victims
- HUD/FHA Section 203(k) Rehabilitation Mortgage Insurance
- HUD Partnership for Advancing Technology in Housing
- HUD Section 108 Loan Guarantee Programs
- Internal Revenue Service Casualty Loss-Special Disaster Provisions
- NOAA National Weather Service StormReady® Program
- USDA Natural Resources Conservation Service (NRCS) Easement Programs
- Small Business Administration Disaster Loan Programs
- United States Army Corps of Engineers (USACE) General Investigation (GI)
- USACE Continuing Authorities Program
- USACE Flood Plain Management Services Program (FPMS)
- USACE Inspection of Completed Works Program (ICW)
- USACE National Levee Safety Program
- USACE Planning Assistance to States
- USACE Rehabilitation and Inspection Program (RIP)
- United States Department of Agriculture (USDA)/Farm Service Agency (FSA) Emergency Conservation Program
- USDA/FSA Emergency Farm Loans
- USDA/Emergency Forest Restoration Program (EFRP)
- USDA Non-insured Crop Disaster Assistance Program (NAP)
- USDA/NRCS Emergency Watershed Protection Program
- USDA/NRCS Watershed Protection and Flood Prevention Program
- USDA Home Renovation Loans
- USDA/Rural Housing Service (RHS) Community Facilities Loans and Grants
- USDA/RHS Rural Housing Assistance
- USDA/RHS Section 502 Single-Family Housing Direct and Guaranteed Loans
- USDA/RHS Single Family Housing Repair Loans & Grants
- USDA/RHS Mutual Self-Help Housing Technical Assistance Grants
- USDA/Risk Management Agency Federal Crop Insurance Program
- USDA/Rural Development Business & Industry Loan Guarantees

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 Hurricane Preparedness Week. Some

communities have their own public information or communications office to handle outreach initiatives. Overall, programs not relating to certification are not common within the County. East Washington Borough conducts a neighborhood and stream and bank clean up, organized by the Mayor and Council.

Perhaps the largest and most extensive education and outreach opportunity is the Washington County Public Safety website. This site provides a variety of educational resources. These include a severe weather presentation, information on the NWS rain gauges and the automated flood warning system, and a course registration system that allows both individual users and groups to register for public safety courses. Canton and Fallowfield Townships routinely update their residents with educational and preventive hazard topics in their newsletter and website. Peters Township hosts a 'Community Risk Reduction' group that works with personal care homes, schools, and daycares to assist with emergency operations plans. They will work to evaluate the risks and address target hazards within the community.

The National Fire Protection Association (NFPA) administers the Firewise USA® Program to encourage local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. The program provides resources to help homeowners learn how to adapt to living with wildfire and encourages neighbors to work together to take action to prevent losses. The national Firewise USA® Recognition Program has nearly 1,000 active member communities in 40 states, as well as a participation retention rate of 80 percent over the past decade. The program, aimed at homeowners, provides specific criteria for communities regarding wildfire preparedness, and offers national recognition for their work. According to the PA DCNR, Firewise USA® has replaced Firewise Communities which was discontinued in 2019.

StormReady® 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. All of Pennsylvania's 67 counties meet enrollment criteria. In addition to Washington County, Allenport Borough, Canton Township, Charleroi Borough, Stockdale Borough, North Strabane Township, and California University of Pennsylvania meet the requirements of and are enrolled in StormReady®. Locations that do not meet StormReady® criteria can demonstrate their support for weather safety by joining the StormReady® Supporter program.

5.2.5. Plan Integration

This section highlights key opportunities for plan integration in Washington County. Plan integration recognizes that hazard mitigation is most effective when it works in concert with other plans, regulations, and programs. Per FEMA, plan integration is described as the regular consideration and management of hazard risks in a community's existing planning framework. Plan integration is the process by which communities critically analyze their existing planning framework and align efforts to build a safer, smarter community. Plan integration involves a two-way exchange of information and incorporation of ideas and concepts between hazard mitigation plans (state and local) and other community plans. Specifically, plan integration

involves the incorporation of hazard mitigation principles and actions into community plans and community planning mechanisms into hazard mitigation plans (FEMA, 2015).

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

The County Comprehensive Plan, EOP, and various land use ordinances and regulations provided key information for developing the HMP. These documents are referenced where appropriate throughout the plan and links to the documents are included in Appendix A: Bibliography.

Moving forward, each of these documents should not be treated as unrelated and updated separately. The County and each participating municipality are responsible for incorporating the specific mitigation actions recommended in this plan into the necessary planning documents, including the comprehensive plan, the County EOP, and any land use ordinances and regulations.

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

Washington County will integrate the Hazard Mitigation Plan into the County's Comprehensive Plan as it is updated and has asked the Comprehensive Plan contractor to recommend additional areas for integration. The County will also communicate with local governments to encourage them to incorporate the HMP into their local plans as applicable.

Plan integration is not only accomplished through the MPC and planning tools such as comprehensive plans and zoning ordinances, but through capital improvement planning, area plans such as highway corridors and downtown plans, functional plans like stormwater and open space plans, and public and stakeholder outreach and education.

Washington County Comprehensive Plan

The HMP's Risk Assessment and Future Development and Vulnerability discussions provides information for the update of the County Comprehensive Plan and any local comprehensive plans by making available specific risk and vulnerability information for the entire County and

more specifically the potential areas of growth. The Planning Commission's meetings are open to the public and are advertised according to the Pennsylvania Sunshine Act (65 PA C.S.A.).

Article III of the Pennsylvania Municipalities Planning Code (Act 247 of 1968, as reenacted and amended) requires all Pennsylvania counties (except Philadelphia) to adopt a comprehensive plan and update it at least every 10 years. Coupling this requirement with the DMA 2000-required five-year update cycle for HMPs, when possible, will allow the County to better integrate the County Comprehensive Plan and Multi-Jurisdictional HMP planning processes and strengthen public participation for both efforts.

Washington County's current Comprehensive Plan was adopted on November 23, 2005, and is currently in the process of being updated. This plan provides general direction and a blueprint for the future of Washington County and constituent communities. As required by the Municipalities Planning Code, the Comprehensive Plan is currently being updated and should be completed sometime in 2021 or 2022. Recommendations from the HMP can be incorporated into the document, especially in defining environmentally sensitive or high-risk areas. There is also an opportunity to use the HMP's risk assessment to help define where future growth and development should be directed.

In Washington County both the HMP and comprehensive plan are currently used to mutually support integrated content. HMP data is available to update the County and local comprehensive plans and ensures hazard mitigation elements are considered in planning documents, ordinances, and funded development projects.

Washington County should continue to make hazard data available when the 2021 HMP update is complete. The updated hazard data can be used to help update the County and local comprehensive plans and other planning documents. Additionally, hazard related data from consistency reviews should be transmitted annually to be used as part of the County's annual HMP review. This data can be used to help track plans and projects not only for the annual HMP review but for the 2026 HMP update.

Washington County Emergency Operations Plan

The Pennsylvania Emergency Management Services Code (35 PA C.S. Sections 7701-7707, as amended) requires each County and municipality to prepare, maintain, and keep current an Emergency Operations Plan (EOP). The Washington County Emergency Management Agency is responsible for preparing and maintaining the County EOP. The risk assessment information presented in the existing HMP was used to update the hazard vulnerability assessment section of the County EOP. The updated risk assessment information will affect subsequent updates to the EOP.

The EOP is reviewed at least biennially. Whenever portions of the plan are implemented in an emergency event or training exercise, a review is performed and changes are made where

necessary. These changes are then distributed to the County's 66 local Emergency Management Coordinators (EMCs) for safekeeping.

The Washington County Emergency Management Agency should consider the County's HMP during its biennial review of the County EOP. Recommended changes to the HMP will then be coordinated with the Steering Committee.

Jefferson Township will be updating its EOP in 2024, and Burgettstown Borough completed its update in January 2021, including recognition of additional hazards. East Washington Borough's EOP was finalized in March 2020, and Fallowfield Township's was finalized in May 2019. Independence and South Strabane Townships will be updating their EOP in 2022.

North Strabane Township will be updating its plan in 2021 and will focus on including manmade incidents and pandemics due to the events of COVID-19. Nottingham Township recently finalized its plan in February 2021 to include procedures for disasters, chain of command, and local government procedures whether natural or human caused. North Franklin Township has an evacuation plan pertaining to Dams 3 and 4 and participated in the County's EOP. COVID-19 delayed West Pike Run Township's update to the EOP and evacuation plan.

Peters Township's 2019 EOP is reviewed annually and establishes a framework to ensure that the Township will be prepared to deal with all hazards threatening the lives and property of the Township. The responsibilities and coordination mechanisms of the Township, non-governmental, and private agencies are outlined in the event of a disaster. The EOP also coordinates recovery and response activities with voluntary organizations active in disasters and the business community.

Washington County Act 167 Stormwater Management Plan

Act 167 requires that all stormwater management plans include an analysis of present and projected land development in flood hazard areas, and its sensitivity to damages from future flooding or increased runoff. In drafting the Washington County Act 167 Stormwater Management Plan, this HMP's hazard profile on floods, flash floods, and ice jams was consulted to identify the location and extent of flooding, range of magnitude, past occurrences, likelihood of future occurrences, and vulnerability assessment due to flooding events. The floodplain maps included in this HMP were also used as a reference to meet Act 167 requirements.

In addition, Act 167 requires the identification of existing and proposed state, federal, and local flood control projects located in the watershed and their design capacities. Appendix I of this HMP, which contains maps and summaries of federal, state, and local flood control projects, was referenced in the drafting of the Plan.

Like the HMP, stormwater management plans must be reviewed (and revised, if necessary) every five years. The stormwater management plan was adopted in June 2010. Information developed in the revision of one plan can be incorporated into the revision of the other.

Washington County and its municipalities must ensure that the components of the HMP are integrated into existing community planning mechanisms and are generally consistent with goals, policies, or recommended actions. Washington County and the Hazard Mitigation Steering Committee will utilize the existing maintenance schedule of each plan to incorporate the goals, policies, or recommended actions as each plan is updated.

6. Mitigation Strategy

6.1. Update Process Summary

6.1.1. Mitigation Goal and Objective Review

Mitigation goals are general guidelines that explain what the County wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date.

Based on results of the goals and objectives evaluation exercise and input from the County, a list of goals and corresponding objectives was developed for the 2015 plan. There were five goals and 16 objectives identified in the 2015 Washington County Hazard Mitigation Plan Update. The HMPSC reviewed the 2015 goals and objectives during a Steering Committee Review Meeting on March 30, 2021. The HMPT reviewed the goals and objectives during the Risk Assessment and Mitigation Solutions Meeting on April 27, 2021. The review of the goals and objectives is summarized below in Table 6.1.1-1.

Table 6.1.1-1 Review of Changes to the 2015 HMP Goals and Objectives

Goal 1: Plan to reduce current and future risk of damage from natural and man-made disasters.	
Objective 1.1: Using planning tools and regulation to direct development towards areas that are not identified hazard areas.	**Review:** The HMPSC agreed that this goal should be continued into the 2021 plan. Objectives 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, and 1.8 have also been continued into the 2021 plan.
Objective 1.2: Review all comprehensive plans to ensure that designated growth areas are not in hazard areas.	
Objective 1.3: Review adoption and enforcement of the Uniform Construction Code (UCC) building codes.	
Objective 1.4: Review all capital improvement plans to ensure that infrastructure improvements are not directed towards hazardous areas.	
Objective 1.5: Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.	
Objective 1.6: Improve the enforcement of existing floodplain regulations.	
Objective 1.7: Advocate for policies that provide affordable and available flood insurance.	
Objective 1.8: Evaluate existing shelters to determine adequacy for current and future populations.	
Goal 2: Reduce the potential impact of natural and man-made disasters on public and private property.	
Objective 2.1: Encourage municipal participation in the National Flood Insurance Program and encourage property owners, renters and businesses to purchase appropriate insurance.	**Review:** The HMPSC agreed that this goal should be continued into the 2021

Table 6.1.1-1 Review of Changes to the 2015 HMP Goals and Objectives	
Objective 2.2: Protect the County's most vulnerable populations, buildings, and critical facilities through the implementation of cost-effective and technically feasible mitigation projects.	plan. Objectives 2.1 and 2.2 have been continued into the 2021 plan.
Goal 3: Reduce or redirect the impact of natural disasters, especially floods, away from at risk population areas	
Objective 3.1: Research possible mitigation projects to reduce flooding, reduce/eliminate sewage leakage and inflow/infiltration problems. Some projects may include reservoirs, levees, floodwalls, diversions, channel modification, and storm sewers	**Review:** The HMPSC agreed that this goal should be continued into the 2021 plan. Objectives 3.1 and 3.2 have been continued into the 2021 plan.
Objective 3.2: Gather existing studies for transportation, storm water and other infrastructure to further integration of mitigation into existing projects and use existing evaluations to support potential mitigation projects.	
Goal 4: Protect existing natural resources and open space, including parks and wetlands, within the floodplain and watershed to improve their flood control function.	
Objective 4.1: Protect natural resources through the implementation of cost-effective and technically feasible mitigation projects.	**Review:** The HMPSC agreed that this goal should be continued into the 2021 plan. Objectives 4.1 and 4.2 have been continued into the 2021 plan.
Objective 4.2: Protect natural resources through the implementation of recreation planning and storm water management planning	
Goal 5: Protect public health, safety, and welfare by increasing the public awareness of existing and potential hazards and by fostering both individual and public responsibility in mitigating risks due to those hazards.	
Objective 5.1: Develop and distribute public awareness materials about natural hazard risks, preparedness, and mitigation	**Review:** The HMPSC agreed that this goal should be continued into the 2021 plan. Objectives 5.1 and 5.2 have been continued into the 2021 plan.
Objective 5.2: Target owners of properties within identified hazard areas for additional outreach regarding mitigation and disaster preparedness.	

6.1.2. Mitigation Progress and Success

For the plan update, Washington County Department of Public Safety and individual municipalities provided progress on mitigation actions and success that were accomplished since 2015. As of May 2021, 11 of 66 municipalities submitted the Mitigation Action Review. This section reflects progress and successes as of May 2021.

There were 35 actions identified in the 2015 HMP. Mitigation actions have been carried over and developed for the County as well as for each participating jurisdiction. While some actions may be more general in nature and could apply to more than one jurisdiction, most actions are specific to individual jurisdictions. The mitigation actions that were developed were based on the following: issues identified in the Hazard Identification and Risk Assessment, gaps identified in the mitigation capability analysis, input from the HMPT, and feedback from the Risk Assessment and Mitigation Solutions Workshop held April 27, 2021. These mitigation

actions may be implemented through a variety of local tools such as: changes in ordinances and policies, inclusion into capital improvements budgets, and grant funding.

County and Municipal actions in the 2015 Plan were distributed at the April 2021 Mitigation Solutions workshop for review and update. Each action has been assigned one of the following categories:

- "Completed" – Actions that were completed since the adoption of the 2015 Plan
- "Canceled" – Actions that were terminated.
- "Deferred" – Actions that had not been initiated since the adoption of the 2015 Plan
- "On-Going" – Actions that are performed on a regular and continuous basis by the department

All existing mitigation actions have been carried over into the 2021 Hazard Mitigation Plan as they are continuous actions or actions that were not completed.

A list of these actions as well as their status is included in Table 6.1.2-1. Actions were evaluated by the HMPT and municipal officials with the intent of producing a usable mitigation action plan in 2021 with actions and projects that could be completed over the next five years. Appendix C contains a summary of responses provided by municipalities to the *Mitigation Action Progress Report Form*.

In 2015 Washington County's Risk MAP process was completed. Throughout the Risk MAP process, communities were able to get a better understanding of their flood risk, and all communities updated their floodplain ordinances. Many noted that the 2015 ordinances were stricter than previous ordinances. All communities reporting this progress via the NFIP compliance form note that the PA model ordinance was used. In addition, the non-regulatory Risk MAP products are used in a number of communities to communicate risk. While this does not necessarily represent a permanent risk reduction, the awareness can help build community understanding of risk. In the County, 60 of 66 communities participate in the NFIP.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
1	Identify, acquire, and demolish structure with the highest relative vulnerabilities.	Allenport Borough, Amwell Township, Beallsville Borough, Bentleyville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canonsburg Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Claysville Borough, Coal Center Borough, Cokeburg Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley	**Ongoing**. Completed by **Donora Borough, Union Township** and **East Bethlehem Township**. **Fallowfield Township** officials note that assessment of the Township's waterways has been performed and no structures of this nature are present. Cancelled by **North Franklin Township** and **Smith Township. East Finley Township** made progress on this action by demolishing and building a new

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
		Township, East Washington Borough, Elco Borough, Ellsworth Borough, Fallowfield Township, Finleyville Borough, Green Hills Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, City of Monongahela, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Franklin Township, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Franklin Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, City of Washington, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Middletown Borough, West Pike Run Township	garage for its municipal fleet. **Morris Township** notes that all past flood damaged structures have been demolished. **Hopewell Township** is trying to combat this issue as it occurs. They received funding from DCNR DGLVR for culvert, drainage, and streambank stability. Ongoing for **Carroll, South Strabane, New Eagle Borough,** and **Canton Townships** and **Long Branch Borough**. **West Finley Township** and **Elco Borough** noted completed. **Charleroi Borough** deferred the action. **Bentleyville, Canonsburg, Green Hills,** and **Ellsworth Boroughs** and **South Franklin Township** removed the action. **Roscoe Borough** noted the action as ongoing and they are working to access grant funding.
2	Develop plans for potential hazards related to natural gas development.	Deemston Borough, Houston Borough, Independence Township, South Strabane Township	**South Strabane Township** noted plans are required per the EOP. Plans are also required from oil and gas companies per the Township's zoning code and DEP permitting. Public safety staff engage in training and site visits. **Ongoing** for other communities.
3	Community Outreach and Education regarding flood risk aimed at increasing individual mitigation actions including purchasing NFIP insurance and elevating utilities.	All municipalities in Washington County	**Ongoing**. **East Finley Township, Smith Township, Roscoe Borough, Union Township and Donora Borough** noted this action as ongoing. **Morris and North Franklin Townships** update the township websites with information and information on stormwater management and the NFIP as needed. **Fallowfield Township** noted that community outreach pertaining to this action has not been implemented but is ongoing. Ongoing for **Carroll, Canton, South Strabane,** and **Hopewell Townships** and **Long Branch, Elco,** and **New Eagle Boroughs**. **Canonsburg Borough** noted they will continue community outreach to educate citizens on flooding hazards.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
			Claysville and **Charleroi Boroughs** and **East Bethlehem Township** deferred this action. **West Finley Township** noted completed. **Bentleyville, Green Hills,** and **Ellsworth Boroughs** and **South Franklin Township** removed the action.
4	Drainage System Maintenance along Ten Mile Creek.	West Bethlehem Township	No update submitted, so action will continue as **ongoing**.
5	Encourage the municipalities to conduct annual reviews of zoning regulations meant to ensure a reduction in development in high hazard areas. The Washington County Planning Commission is responsible for reviewing subdivision and land development ordinances.	All municipalities in Washington County	**Ongoing**. **Smith, Union** and **East Bethlehem Townships, and Roscoe Borough** report that this action is ongoing. **Donora, Long Branch, New Eagle, Elco, Canonsburg, and Charleroi Boroughs** and **Carroll** and **Hopewell Townships** noted this action has been completed and is ongoing. **Bentleyville, Green Hills,** and **Ellsworth Boroughs** and **South Franklin Township** removed the action. **Canton Township** is in the final review of their zoning regulations. **East Finley Township** addresses this action by using FEMA's National Incident Management System to identify high hazard areas. The **Fallowfield Township** Board of Supervisors works closely with the Township's Zoning Officer and Emergency Management Team to keep up to date on high hazard areas. **Morris Township** is in the process of updating the zoning code. **North Franklin Township** updated the zoning ordinance in 2018. **South Strabane Township's** subdivision and zoning regulations are in place. In 2020, the Township adopted a comprehensive update to grading and steep slope regulations applied to all new developments. The **City of Washington** and **East Washington Borough** completed a new multi-municipal zoning and SALDO in 2017 incorporating the latest mitigation regulations and is ongoing. **Claysville Borough** deferred this

Table 6.1.2-1 Five-Year Mitigation Plan Action Review			
2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
			action. **West Finley Township** noted completed.
6	Use information developed in the mitigation plan update process to update County and municipal comprehensive plans, especially where it relates to high hazard areas identified in this plan.	All municipalities in Washington County	Canceled by **North Franklin Township**. **Donora and Elco Boroughs** noted this action was addressed since the 2015 HMP and is ongoing. **Morris, East Bethlehem,** and **Smith Townships, and Roscoe Borough** noted the action as ongoing. **East Finley Township** works with local coal and gas companies to mitigate risk for ponds and dams in high hazard areas. **Fallowfield Township** will use the information gathered Countywide during the update to apply to the Township's specific needs. Ongoing for **Carroll, Canton,** and **Hopewell Townships**, and **Charleroi, New Eagle,** and **Long Branch Boroughs** completed the action and is ongoing. In 2017, **South Strabane Township** performed a comprehensive update to the Comprehensive Land Use Plan. Steep slope areas were identified in plan update. Further updates will be deferred until the HMP is complete. **Claysville Borough** deferred this action. **West Finley Township** noted completed and the possibility for an update. **Union Township** noted completed and included as part of MCM #3 in the MS4 Program. **Bentleyville, Canonsburg, Green Hills,** and **Ellsworth Boroughs** and **South Franklin Township** removed the action.
7	Encourage all municipal offices to review the statewide Uniform Construction Code to ensure the enforcement of these codes as a minimum standard.	Claysville Borough, Washington County	**Ongoing**. **Claysville Borough** deferred this action.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
8	Encourage applicable municipal offices to review their capital improvement plans to ensure that programmed infrastructure improvements are not in high hazard areas.	Claysville Borough, Canonsburg Borough, Washington County	**Ongoing**. **Claysville Borough** deferred this action. **Canonsburg Borough** has canceled this action.
9	Encourage annual reviews of County and municipal floodplain ordinances to ensure compliance with the NFIP.	Donora Borough, City of Washington, Washington County	**Donora Borough** noted this action was addressed since the 2015 HMP and is ongoing. The **City of Washington** and **East Washington Borough** updated its floodplain ordinance to current NFIS program standards in September 2015. The ordinance is reviewed annually in conjunction with requirements put forth by the DEP MSF program and is ongoing.
10	Conduct training as required to familiarize County and municipal staff with NFIP requirements, and the Community Rating System (CRS).	Washington County	**Ongoing**.
11	Evaluate power requirements at shelters Countywide with the help of the American Red Cross (ARC) and take necessary steps to provide adequate backup power to those that need it.	Washington County	**Ongoing**.
12	Create a committee to look at challenges associated with sheltering household pets in existing shelters.	Washington County	**Ongoing**.
13	Undertake an education and outreach program meant to familiarize municipalities with subsidence insurance.	Washington County	**Ongoing**.
14	Develop and maintain an asset list of repetitive loss properties, as well as structures located in the regulatory floodplain.	Washington County	**Ongoing**.
15	Work with California University to maintain hazard maps to be used for future mitigation activities.	Washington County	**Ongoing**.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
16	Conduct public outreach to determine the interest of homeowners with repetitive loss properties in selling their properties as a hazard reduction measure. Annually apply for funds to conduct buyouts for interested homeowners.	Carroll Township, Peters Township, Washington County	**Ongoing**. Ongoing for **Carroll Township**.
17	Maintain the "Storm Ready" status awarded by the National Weather Service. This is a biennial review and certification.	Washington County	**Ongoing**.
18	Continue to collect information on potential mitigation grant applications projects including interested property owners, to be ready to apply for mitigation when funding is available.	Washington County	**Ongoing**.
19	Coordinate with partner agencies to obtain relevant information for mitigation projects.	City of Washington, Washington County	**Ongoing**. The **City of Washington** and **East Washington Borough** have worked with the County Planning Commission regarding an Army Corps of Engineers review of flooding concerns. The City is also working with the DEP and the QCCD to prepare and implement their MSR PRP which contains flood mitigation components.
20	Evaluate the feasibility and cost of renovating the Canonsburg dam to turn it into a recreational areas as well as a flood control measure.	Canonsburg Borough, Washington County	**Canonsburg Borough** has canceled this action.
21	Coordinate potential flood mitigation projects with Washington County officials, including watershed groups, and present projects or approval and funding; ongoing projects include identified stormwater management projects, creek bed reclamation, etc.	Allenport Borough, Amwell Township, Beallsville Borough, Bentleyville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canonsburg Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, Ellsworth Borough, Fallowfield Township, Finleyville Borough, Hanover	**Donora Borough** noted this action was addressed since the 2015 HMP and is ongoing. **East Finley Township** works with volunteer watershed associations on flood mitigation projects. **Morris Township** is currently in the process of cleaning creek beds in the area with a watershed group. **North Franklin Township** has several projects in process. The PA DEP awarded the Township a grant for planning of streambank restoration and several other grant applications

Table 6.1.2-1 Five-Year Mitigation Plan Action Review			
2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
		Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Franklin Township, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Franklin Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	have been submitted. The Township will be working with the Washington County Watershed Alliance on these projects. **Smith Township, Charleroi, Long Branch,** and **New Eagle Boroughs, Hopewell, Canton, East Bethlehem, Roscoe Borough, Union Township** and **Carroll Townships** noted that this action is ongoing. **Fallowfield Township** deferred this action. The **City of Washington** and **East Washington Borough** are working with the DEP and the Washington County Conservation District to prepare and implement the MS4 PRP which contains flood mitigation components. **South Strabane Township** noted ongoing and completed and continues to seek funding and devote local resources for the Manifold Road streambank restoration project. The Township also received money from the County to put to the project. **Canonsburg Borough** continues ongoing efforts to identify problem areas for stormwater management and to implement processes to mitigate future occurrences. **West Finley Township** and **Elco Borough** noted completed. **Bentleyville** and **Ellsworth Boroughs** and **South Franklin Township** removed the action.
22	Develop and maintain a list detailing the location of natural resource areas throughout the County. Use list to create maps and other relevant data for future mitigation activities.	Washington County	**Ongoing**.
23	Conduct reviews of the 2010 stormwater management plan (phase II) and recreation plan for needed updates (if any).	West Brownsville Borough, Washington County	No update submitted, so action will continue as **ongoing**.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review			
2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
24	Coordinate with DEP, related conservation agencies, and watershed groups to research and identify flood control opportunities through restoration of reclaimed areas, i.e. open space, green space, etc.	Washington County	**Ongoing**.
25	Create a variety of displays to be used at public events that cover topics including: mitigation, animals in disaster, business continuity and children's programs. These displays will appeal to different audiences and different events and can be supplemented with FEMA resources as handouts and giveaways.	South Strabane Township, Washington County	**Completed and ongoing**. Each monthly board meeting allows time for public comment specifically related to stormwater issues. Information is also provided on **South Strabane Township's** website, and the quarterly newsletter is mailed to each home.
26	Maintain a list of media contacts to be used when release of hazard information is necessary.	Washington County	**Ongoing**.
27	Develop a series of presentations that explain the hazards facing Washington County and how to best protect oneself from their effects. These presentations should be able to be tailored to different groups.	Washington County	**Ongoing**.
28	Coordinate with the ARC to ensure that educational opportunities are presented on a regular basis.	South Strabane Township, Washington County	**South Strabane Township** noted ongoing and would like to participate with ARC once additional information is provided.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review			
2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
29	Update the WCDPS website. Update is to include information on all 4 phases of emergency management, as well as presenting current weather, stream level data, iFLOWs data and any other pertinent warning information.	Washington County	**Ongoing**.
30	Identify local spaces willing to display and distribute information to citizens on topics like: preparedness, NFIP, FIRMs, etc.	Washington County	**Ongoing**.
31	Establish a program that contacts those living in structures located within the regulatory floodplain and provides information related to flood safety, flood insurance, and property protection measures, including elevation.	Washington County	**Ongoing**.
32	Encourage the tax assessment office to continue compiling information on structures located in the regulatory floodplain, as well as those that have a history of flood losses.	Washington County	**Ongoing**.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
33	Develop grant applications to suitably protect repetitive-loss properties 1% annual chance floodplain (for owners interested in FEMA mitigation funding), including through elevation.	Allenport Borough, Amwell Township, Beallsville Borough, Bentleyville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canonsburg Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, Ellsworth Borough, Fallowfield Township, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Franklin Township, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Franklin Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	Canceled by **Fallowfield Township and North Franklin Township**. Fallowfield Township noted the action did not seem to pertain to the Township at this time. **Donora Borough** noted this action was addressed since the 2015 HMP and is ongoing. **Morris Township, Roscoe Borough** and **Canton Township** noted the action as ongoing. Ongoing for **Carroll Township** and **Long Branch Borough**. **East Finley**, **Hopewell,** and **East Bethlehem Township, New Eagle, Charleroi, and Elco Boroughs, and Union** and **Smith Townships** have deferred the action. The **City of Washington** and **East Washington Borough** have received PA DEP grants relating to its PRP project. Additionally, it continues to seek further funding relating to construction costs. **South Strabane Township** noted ongoing and completed and continues to seek funding and devote local resources for the Manifold Road streambank restoration project. The Township also received money from the County to put to the project. Private investment is also being sought after from businesses that are affected or have experienced significant loss to stream flooding. **West Finley Township** noted completed. **Bentleyvilles Canonsburg,** and **Ellsworth Boroughs** and **South Franklin Township** removed the action.
34	Develop grant applications to suitably protect and continue operations of critical facilities	Allenport Borough, Amwell Township, Beallsville Borough, Bentleyville Borough, Blaine Township, Buffalo Township,	Cancelled by **Canonsburg Borough**, **Fallowfield Township and North Franklin Township**. **Smith, Union**

Table 6.1.2-1 Five-Year Mitigation Plan Action Review

	2015 HMP ACTION	COMMUNITY	2021 HMP REVIEW COMMENTS
	in the 1% annual chance floodplain, including through wet and dry floodproofing.	Burgettstown Borough, California Borough, Canonsburg Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, Ellsworth Borough, Fallowfield Township, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Franklin Township, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Franklin Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	**and East Bethlehem Townships** and **Charleroi and Elco Boroughs** deferred this action. Ongoing for **Carroll, Canton,** and **Hopewell Townships** and **Long Branch, Roscoe** and **New Eagle Boroughs**. **South Strabane Township** actively maintains critical facilities through MS4 permit requirements. Additionally, in 2000, the Township partnered with a local volunteer fire department to complete a pipe replacement project for stormwater discharge into a neighboring creek. **West Finley Township** noted completed. **Bentleyville** and **Ellsworth Boroughs** and **South Franklin Township** removed the action.
35	Develop project inventory and grant applications to suitably protect infrastructure from the effects of rockslides and road slip.	All municipalities in Washington County	Cancelled by **North Franklin** and **South Franklin Townships** and **Bentleyville, Canonsburg, Green Hills,** and **Ellsworth Boroughs**. **East Finley Township** notes this is addressed as needed, but that most landslide effects are small in the township. **Fallowfield Township** is in the process of addressing a major slippage; the Township is working with the PA DCED to acquire grant funding. **Smith, Canton, Hopewell, East Bethlehem,** and **Carroll Townships** and **Charleroi**, **Long Branch, Roscoe** and **New Eagle Boroughs** noted that this action is ongoing. **South Strabane Township** will seek to develop on inventory of projects with more comprehensive approach. Currently, it identified Garber Road slip as a future project.

Table 6.1.2-1 Five-Year Mitigation Plan Action Review			
2015 HMP ACTION		COMMUNITY	2021 HMP REVIEW COMMENTS
			Claysville Borough deferred this action. **West Finley Township and Union Township** noted completed. **Elco Borough** completed the action, but it is ongoing.

Highlighted Mitigation Success Stories

A variety of mitigation progress has been made on hazard mitigation projects and actions in the last five years. Details on numerous actions marked as "Completed" and "Ongoing" are summarized below. Additionally, several municipalities sent information about completed mitigation actions through other forms of correspondence.

- Chartiers Township completed the McClane Farm Road culvert replacement project in April 2021. Using a Greenways Grant, the township designed a larger replacement culvert to pass the 1% annual chance flood. The old culvert was undersized, and misalignment caused water to back up and flood nearby homes and roads during large rain events.
- Donora Borough completed repairs on storm water pipes that go toward the Monongahela River. The pipes were repaired and re-lined to open them up for better flow and to reduce flood risk.
- The City of Washington and East Washington Borough completed a new multi-municipal zoning and SALDO in 2017 incorporating the latest mitigation regulations and is ongoing.
- Hopewell Township has identified issues with their culverts, drainage and streambank stability and is trying to combat these issues as they occur. They received funding from DCNR DGLVR for culvert, drainage, and streambank stability.
- East Finley Township demolished and replaced the township garage after it was identified as having one of the highest risks to flood incidents.
- The City of Monongahela completed improvements along Park Avenue from Pigeon Creek in September 2018. Poor lightning and lack of barriers to close the road created dangerous conditions during flood events. The City was able to acquire treated lumber and built A Frame barricades through donations to the city public works department. The barricade was pained with a bright color and reflective striping was added. The Township also acquired a light plant and generator for the roadway.

- North Strabane Township discovered landslide issues when earth movement on a steep slope in a relatively new housing development compromised four homes and effected a housing development for over two years. The Township strengthened its grading ordinance and changed slope requirements to mitigate the possibility of this happening in the future.
- North Strabane Township is working in an ongoing relationship with Allegheny Health Network and the Washington County Department of Public Safety to report opioid related incidents. The goal is to track the nature of these incidents and analyze data for patterns. Additionally, the North Strabane Police and Fire Departments carry Narcan on all units so they can provide emergency care when needed.
- Fallowfield Township is in the process of addressing a major slippage; the Township is working with the PA DCED to acquire grant funding.
- The City of Washington and East Washington Borough have received PA DEP grants relating to its PRP project. Additionally, it continues to seek further funding relating to construction costs.
- South Strabane Township actively maintains critical facilities through MS4 permit requirements. Additionally, in 2000, the Township partnered with a local volunteer fire department to complete a pipe replacement project for stormwater discharge into a neighboring creek.
- In 2017, South Strabane Township performed a comprehensive update to the Comprehensive Land Use Plan. Steep slope areas were identified in plan update. Further updates will be deferred until the HMP is complete.
- South Strabane Township has received money from Washington County to put towards the Manifold Road streambank restoration project. While this project was started with County funding, the township continues to seek funding and devote local resources to complete the project. Private investment is also being sought after from businesses that are affected or have experienced significant loss to stream flooding.
- Roscoe Borough noted significant progress to keep catch basins clear than in previous years.
- South Franklin Township worked with the County and USACE to clean Chartiers Creek and its tributaries. The Creek is known to wash out park areas and fences but not reach residential properties.
- Lone Pine Golf Course, located in Green Hills Borough, had proposed straightening Chartiers Creek to improve aesthetics. The Borough denied the request as the change would increase the Creek's velocity downstream.

6.2. Mitigation Goals and Objectives

Based on results of the goals and objectives evaluation exercise and input from the County, it was confirmed that the 2015 goals and objectives still align with the County's vision. Tables 6.1.1-1 explains how goals and objectives were updated and revised. Table 6.2.1-1 lists the mitigation goals and objectives established for the 2021 plan. There are 5 goals and 16 objectives identified.

Table 6.2.1-1	2021 Mitigation Goals and Objectives
Goal 1	Plan to reduce current and future risk of damage from natural and man-made disasters.
Objective 1.1	Using planning tools and regulation to direct development towards areas that are not identified hazard areas.
Objective 1.2	Review all comprehensive plans to ensure that designated growth areas are not in hazard areas.
Objective 1.3	Review adoption and enforcement of the Uniform Construction Code (UCC) building codes.
Objective 1.4	Review all capital improvement plans to ensure that infrastructure improvements are not directed towards hazardous areas.
Objective 1.5	Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.
Objective 1.6	Improve the enforcement of existing floodplain regulations.
Objective 1.7	Advocate for policies that provide affordable and available flood insurance.
Objective 1.8	Evaluate existing shelters to determine adequacy for current and future populations.
Goal 2	Reduce the potential impact of natural and man-made disasters on public and private property.
Objective 2.1	Encourage municipal participation in the National Flood Insurance Program and encourage property owners, renters and businesses to purchase appropriate insurance.
Objective 2.2	Protect the County's most vulnerable populations, buildings, and critical facilities through the implementation of cost-effective and technically feasible mitigation projects.
Goal 3	Reduce or redirect the impact of natural disasters, especially floods, away from at risk population areas
Objective 3.1	Research possible mitigation projects to reduce flooding, reduce/eliminate sewage leakage and inflow/infiltration problems. Some projects may include reservoirs, levees, floodwalls, diversions, channel modification, and storm sewers
Objective 3.2	Gather existing studies for transportation, storm water and other infrastructure to further integration of mitigation into existing projects and use existing evaluations to support potential mitigation projects.

Table 6.2.1-1	2021 Mitigation Goals and Objectives
Goal 4	Protect existing natural resources and open space, including parks and wetlands, within the floodplain and watershed to improve their flood control function.
Objective 4.1	Protect natural resources through the implementation of cost-effective and technically feasible mitigation projects.
Objective 4.2	Protect natural resources through the implementation of recreation planning and storm water management planning
Goal 5	Protect public health, safety, and welfare by increasing the public awareness of existing and potential hazards and by fostering both individual and public responsibility in mitigating risks due to those hazards.
Objective 5.1	Develop and distribute public awareness materials about natural hazard risks, preparedness, and mitigation
Objective 5.2	Target owners of properties within identified hazard areas for additional outreach regarding mitigation and disaster preparedness.
Goal 6	Implement structural projects to reduce the impacts of hazards.
Objective 6.1	Address the risks posed by the potential failure of High Hazard Potential Dams within the County.

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 (SOG), identify four categories of hazard mitigation techniques.

- Local plans and regulations: Government authorities, policies, or codes that influence the way land and buildings are developed and built. Examples include, but are not limited to, comprehensive plans, subdivision regulations, building codes and enforcement, and NFIP and CRS.
- Structure and infrastructure: Modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. Examples include, but are not limited to, acquisition and elevation of structures in flood prone areas, utility undergrounding, structural retrofits, floodwalls and retaining walls, detention and retention structures, and culverts.

- Natural systems protection: Actions that minimize damage and losses and preserve or restore the functions of natural systems. Examples include, but are not limited to, sediment and erosion control, stream corridor restoration, forest management, conservation easements, and wetland restoration and preservation.
- Education and awareness: Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate the hazards and may also include participation in national programs. Examples include, but are not limited to, radio or television spots, websites with maps and information, provide information and training, NFIP outreach, StormReady, and Firewise Communities.

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 Washington County

HAZARD *(in order of Risk Factor Ranking)*	MITIGATION TECHNIQUE			
	PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS
Pandemic/Infectious Disease (N)	X			X
Flood, Flash Flood, Ice Jam (N)	X	X	X	X
Landslide (N)	X	X	X	X
Winter Storm (N)	X	X	X	X
Tornado, Windstorm (N)	X	X	X	X
Subsidence, Sinkhole (N)	X	X	X	X
Transportation Incident (M)	X	X		X
Conventional Oil and Gas Wells (M)	X	X	X	X
Unconventional Oil and Gas Wells (M)	X	X	X	X
Opioid Addiction & Response (M)	X			X
Drought (N)	X	X	X	X
Dam Failure (M)	X	X	X	X
Utility Interruption (M)	X	X		X
Civil Disturbance (M)	X			
Radon Exposure (N)	X	X	X	X
Earthquake (N)	X	X	X	X

6.4. Mitigation Action Plan

A kick-off meeting for the 2021 Washington County Hazard Mitigation Plan Update was held on March 16, 2021 to develop a framework for the plan. The goals and objectives were presented during this meeting. During the Risk Assessment and Mitigation Solutions Workshop on April 27, 2021, Mitigation Techniques were discussed using FEMA's *Mitigation*

Ideas document. During the workshop, municipalities were provided their *Mitigation Action Progress Report Form* which listed their actions and projects from the 2015 HMP for review and update as described in Section 6.1. Actions that have been deferred or ongoing have been carried over to the 2021 Action Plan and are again proposed for implementation.

In addition, participants were given *Mitigation Action Forms* to provide any new actions or projects to be included in the plan update. Mitigation Action forms were also posted to the project website and sent out via email (or post if requested). Meeting participants who were not affiliated with a municipality were provided with *New Mitigation Action Forms* to include new mitigation actions in the 2021 plan if they so wished.

The final list of 54 mitigation actions is contained in Table 6.4-1. This table provides an overview of the strategy that will be utilized in order to implement each of the proposed mitigation actions. For each action listed in Table 6.4-1, the associated strategy identifies the agency or job title that will be responsible for initiating the work and potential sources of funding for the work. Each strategy also indicates a timeframe for when the action will happen.

At least one mitigation action was established for each hazard in Washington 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 Washington County Mitigation Action Plan	
ACTION NO: 1	Identify, acquire, and demolish structure with the highest relative vulnerabilities.
Community: Allenport Borough, Amwell Township, Beallsville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Claysville Borough, Coal Center Borough, Cokeburg Borough, Cross Creek Township, Deemston Borough, Donegal Township, Dunlevy Borough, East Finley Township, East Washington Borough, , Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Somerset Township, South Franklin Township, Speers Borough, Stockdale Borough, Twilight Borough, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Middletown Borough, West Pike Run Township	
Category	Structure and Infrastructure (NFIP)
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, municipalities
Implementation Schedule	Multi-year
Potential Funding Sources	HMGP

Table 6.4-1 2021 Washington County Mitigation Action Plan	
ACTION NO: 2	Develop plans for potential hazards related to natural gas development.
Community: Deemston Borough, Houston Borough, Independence Township, South Strabane Township	
Category	Local Plans and Regulations
Hazard(s) Addressed	Environmental Hazards
Lead Agency/Department	Local EMC
Implementation Schedule	1 year
Potential Funding Sources	Deemston Borough, Houston Borough, Independence Township, South Strabane Township
ACTION NO: 3*	Community Outreach and Education regarding flood risk aimed at increasing individual mitigation actions including purchasing NFIP insurance and elevating utilities.
Community: All municipalities in Washington County except Bentleyville, Green Hills, and Ellsworth Boroughs and South Franklin Township	
Category	Education and Awareness
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam, Dam Failure
Lead Agency/Department	West Bethlehem Township
Implementation Schedule	2 years
Potential Funding Sources	West Bethlehem Township, PDM Funds, HMGP Funds
ACTION NO: 4	Drainage System Maintenance along Ten Mile Creek.
Community: West Bethlehem Township	
Category	Structure and Infrastructure Projects
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	West Bethlehem Township
Implementation Schedule	1 year
Potential Funding Sources	DCED
ACTION NO: 5	Encourage the municipalities to conduct annual reviews of zoning regulations meant to ensure a reduction in development in high hazard areas. The Washington County Planning Commission is responsible for reviewing subdivision and land development ordinances.
Community: All municipalities in Washington County except Bentleyville, Canonsburg, Green Hills, and Ellsworth Boroughs and South Franklin Township	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety, municipalities
Implementation Schedule	5 years
Potential Funding Sources	Municipal Funds
ACTION NO: 6*	Use information developed in the mitigation plan update process to update County and municipal comprehensive plans, especially where it relates to high hazard areas identified in this plan.
Community: All municipalities, except Union, North Franklin, and South Franklin Townships and Bentleyville, Canonsburg, Green Hills, and Ellsworth Boroughs	

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm; Dam Failure
Lead Agency/Department	Allenport Borough, Carroll Township, Donora Borough, South Strabane Township, Washington, City of, Washington County
Implementation Schedule	5 years
Potential Funding Sources	Municipal Funds
ACTION NO: 7	Encourage all municipal offices to review the statewide Uniform Construction Code to ensure the enforcement of these codes as a minimum standard.
Community: Claysville Borough, Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Claysville Borough, Washington County Planning Department
Implementation Schedule	5 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 8*	Encourage applicable municipal offices to review their capital improvement plans to ensure that programmed infrastructure improvements are not in high hazard areas.
Community: Claysville Borough, Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm; Dam Failure; Utility Interruption
Lead Agency/Department	Claysville Borough, Canonsburg Borough, Washington County Planning Department
Implementation Schedule	5 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 9	Conduct annual reviews of County and municipal floodplain ordinances to ensure compliance with the NFIP.
Community: Donora Borough, Washington, City of, Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Donora Borough, Washington, City of, Washington County Planning Department
Implementation Schedule	5 years
Potential Funding Sources	Municipal Funds
ACTION NO: 10	Conduct training as required to familiarize County and municipal staff with NFIP requirements, and the Community Rating System (CRS).
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County
Implementation Schedule	5 years

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Potential Funding Sources	TBD
ACTION NO: 11	Evaluate power requirements at shelters Countywide with the help of the American Red Cross (ARC) and take necessary steps to provide adequate backup power to those that need it.
Community: South Strabane Township, Washington County	
Category	Structure and Infrastructure Projects
Hazard(s) Addressed	Tornado, Windstorm; Winter Storm
Lead Agency/Department	South Strabane Township, Washington County Department of Public Safety
Implementation Schedule	3 years
Potential Funding Sources	TBD, FEMA HMGP, FEMA PDM
ACTION NO: 12	Create a committee to look at challenges associated with sheltering household pets in existing shelters.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	3 years
Potential Funding Sources	TBD
ACTION NO: 13	Undertake an education and outreach program meant to familiarize municipalities with subsidence insurance.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Subsidence, Sinkholes
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	2 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 14	Develop and maintain an asset list of repetitive loss properties, as well as structures located in the regulatory floodplain.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, Washington County Planning Department
Implementation Schedule	5 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 15	Work with California University to maintain hazard maps to be used for future mitigation activities.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	5 years

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Potential Funding Sources	TBD
ACTION NO: 16	Conduct public outreach to determine the interest of homeowners with repetitive loss properties in selling their properties as a hazard reduction measure. Annually apply for funds to conduct buyouts for interested homeowners.
Community: Carroll Township, Peters Township, Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, Carroll Township, Peters Township
Implementation Schedule	5 years
Potential Funding Sources	TBD, FEMA HMGP, FEMA PDM, FEMA FMA
ACTION NO: 17	Maintain the "Storm Ready" status awarded by the National Weather Service. This is a biennial review and certification.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	4 years
Potential Funding Sources	TBD, Staff Time and Resources
ACTION NO: 18	Continue to collect information on potential mitigation grant applications projects including interested property owners, to be ready to apply for mitigation when funding is available.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	4 years
Potential Funding Sources	TBD, Staff Time and Resources
ACTION NO: 19	Coordinate with partner agencies to obtain relevant information for mitigation projects.
Community: Washington, City of, Washington County	
Category	Structure and Infrastructure Projects, Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington, City of, Washington County Department of Public Safety
Implementation Schedule	5 years
Potential Funding Sources	TBD
ACTION NO: 20	Coordinate potential flood mitigation projects with Washington County officials, including watershed groups, and present projects or approval and funding; ongoing projects include identified stormwater management projects, creek bed reclamation, etc.

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Community: Allenport Borough, Amwell Township, Beallsville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canonsburg Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, , Fallowfield Township, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Franklin Township, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	
Category	Structure and Infrastructure Projects
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, Washington, City of, West Brownsville Borough, Watershed groups
Implementation Schedule	5 years
Potential Funding Sources	TBD, Staff Time and Resources
ACTION NO: 21	Develop and maintain a list detailing the location of natural resource areas throughout the County. Use list to create maps and other relevant data for future mitigation activities.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety, Washington County Planning Department
Implementation Schedule	5 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 22	Conduct reviews of the 2010 stormwater management plan (phase II) and recreation plan for needed updates (if any).
Community: West Brownsville Borough, Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Planning Department, West Brownsville Borough
Implementation Schedule	5 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 23	Coordinate with DEP, related conservation agencies, and watershed groups to research and identify flood control opportunities through restoration of reclaimed areas, i.e. open space, green space, etc.
Community: Washington County	
Category	Structure and Infrastructure Projects, Natural Systems Protection
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, Washington County Planning Department

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Implementation Schedule	5 years
Potential Funding Sources	TBD, FEMA HMGP, FEMA PDM, FEMA FMA
ACTION NO: 24	Create a variety of displays to be used at public events that cover topics including: mitigation, animals in disaster, business continuity and children's programs. These displays will appeal to different audiences and different events and can be supplemented with FEMA resources as handouts and giveaways.
Community: South Strabane Township, Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety, South Strabane Township
Implementation Schedule	3 years
Potential Funding Sources	TBD, Staff Time and Resources, Municipal Funds
ACTION NO: 25	Maintain a list of media contacts to be used when release of hazard information is necessary.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm; Utility Interruption; Civil Disturbance
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	1 year
Potential Funding Sources	Staff Time and Resources
ACTION NO: 26	Develop a series of presentations that explain the hazards facing Washington County and how to best protect oneself from their effects. These presentations should be able to be tailored to different groups.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Radon Exposure; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	2 years
Potential Funding Sources	Staff Time and Resources, County Funds
ACTION NO: 27	Coordinate with the ARC to ensure that educational opportunities are presented on a regular basis.
Community: South Strabane Township, Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Radon Exposure; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety, South Strabane Township, American Red Cross
Implementation Schedule	5 years

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Potential Funding Sources	TBD, Municipal Funds, County Funds
ACTION NO: 28	Update the WCDPS website. Update is to include information on all 4 phases of emergency management, as well as presenting current weather, stream level data, iFLOWs data and any other pertinent warning information.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	2 years
Potential Funding Sources	TBD, Staff Time and Resource, County Funds
ACTION NO: 29	Identify local spaces willing to display and distribute information to citizens on topics like: preparedness, safety, NFIP, FIRMs, utility providers, etc.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Landslide; Subsidence, Sinkhole; Tornado, Windstorm; Winter Storm; Utility Interruption; Civil Disturbance
Lead Agency/Department	Washington County Department of Public Safety
Implementation Schedule	2 years
Potential Funding Sources	Staff Time and Resources
ACTION NO: 30	Establish a program that contacts those living in structures located within the regulatory floodplain and provides information related to flood safety, flood insurance, and property protection measures, including elevation.
Community: Washington County	
Category	Education and Awareness Programs
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, Washington County Planning Department
Implementation Schedule	4 years
Potential Funding Sources	TBD, Staff Time and Resources
ACTION NO: 31	Encourage the tax assessment office to continue compiling information on structures located in the regulatory floodplain, as well as those that have a history of flood losses.
Community: Washington County	
Category	Local Plans and Regulations
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Tax Assessment Office, Washington County Department of Public Safety
Implementation Schedule	5 years
Potential Funding Sources	TBD, Staff Time and Resources

Table 6.4-1 2021 Washington County Mitigation Action Plan	
ACTION NO: 32*	Develop grant applications to suitably protect repetitive-loss properties 1% annual chance floodplain (for owners interested in FEMA mitigation funding), including through elevation.
Community: Allenport Borough, Amwell Township, Beallsville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, municipalities
Implementation Schedule	Multi-year
Potential Funding Sources	HMPG
ACTION NO: 33	Develop grant applications to suitably protect and continue operations of critical facilities in the 1% annual chance floodplain, including through wet and dry floodproofing.
Community: Allenport Borough, Amwell Township, Beallsville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Coal Center Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough, North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Pike Run Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Washington County Department of Public Safety, municipalities
Implementation Schedule	Multi-year
Potential Funding Sources	HMGP
ACTION NO: 34	Develop project inventory and grant applications to suitably protect infrastructure from the effects of rockslides and road slip.
Community: Allenport Borough, Amwell Township, Beallsville Borough, Blaine Township, Buffalo Township, Burgettstown Borough, California Borough, Canton Township, Carroll Township, Cecil Township, Centerville Borough, Charleroi Borough, Chartiers Township, Claysville Borough, Coal Center Borough, Cokeburg Borough, Cross Creek Township, Deemston Borough, Donegal Township, Donora Borough, Dunlevy Borough, East Bethlehem Township, East Finley Township, East Washington Borough, Elco Borough, , Fallowfield Township, Finleyville Borough, Hanover Township, Hopewell Township, Houston Borough, Independence Township, Jefferson Township, Long Branch Borough, Marianna Borough, McDonald Borough, Midway Borough, Monongahela, City of, Morris Township, Mount Pleasant Township, New Eagle Borough, North Bethlehem Township, North Charleroi Borough,	

Table 6.4-1 2021 Washington County Mitigation Action Plan	
North Strabane Township, Nottingham Township, Peters Township, Robinson Township, Roscoe Borough, Smith Township, Somerset Township, South Strabane Township, Speers Borough, Stockdale Borough, Twilight Borough, Union Township, Washington, City of, West Bethlehem Township, West Brownsville Borough, West Finley Township, West Middletown Borough, West Pike Run Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Landslides
Lead Agency/Department	Washington County Department of Public Safety, municipalities
Implementation Schedule	Multi-year
Potential Funding Sources	TBD
ACTION NO: 35	Design and implement storm drain system to handle the rainwater along the length of Wesley Avenue, and the drainage area above the roadway.
Community: Fallowfield Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Fallowfield Township Board of Supervisors, Hatch Engineering
Implementation Schedule	Six months to 1 year
Potential Funding Sources	Act 13 funding, LSA funding, Fallowfield Township general fund
ACTION NO: 36*	Conduct stream bank stabilization to stop erosion before structural integrity of the headwall at Reservoir #2 is compromised.
Community: North Franklin Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam; Dam Failure
Lead Agency/Department	North Franklin Township
Implementation Schedule	Six months to 1 year
Potential Funding Sources	Act 13 funding, LSA funding, Washington County Watershed Alliance, North Franklin Township general fund
ACTION NO: 37	Floodplain restoration on Chartiers Creek including sediment removal.
Community: North Franklin Township	
Category	Natural Systems Protection
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	North Franklin Township
Implementation Schedule	Six months to 1 year
Potential Funding Sources	Act 13 funding, LSA funding, Washington County Watershed Alliance, North Franklin Township general fund
ACTION NO: 38	Stream bank and flood plain restoration on Chartiers Creek. Actions include cutting stream banks back to correct angles, stabilization with native plantings, removal of sedimentation on stream bank, and planting a riparian buffer along 750 feet of Chartiers Creek.
Community: North Franklin Township	
Category	Natural Systems Protection
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam; Landslide
Lead Agency/Department	North Franklin Township

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Implementation Schedule	2 to 3 years
Potential Funding Sources	PA DEP Growing Greener program, PA DCED Watershed Restoration and Protection program, Act 13 funding, LSA funding, Washington County Watershed Alliance, North Franklin Township general fund
ACTION NO: 39	Update the Emergency Operations Plan for pandemic preparedness and response. This process includes identifying equipment needed and needed policy for future pandemic events.
Community: North Strabane Township	
Category	Plans and Regulations
Hazard(s) Addressed	Pandemic and Infectious Disease
Lead Agency/Department	Township Board of Supervisors, Township Manager, and Emergency Management Coordinator
Implementation Schedule	1 year
Potential Funding Sources	State, federal, and private grant funding
ACTION NO: 40	Create and distribute, on campus and elsewhere, educational materials about railway crossing safety.
Community: California Borough / California University	
Category	Education and Awareness Programs
Hazard(s) Addressed	Transportation Incident
Lead Agency/Department	California Borough & California University of PA
Implementation Schedule	N/A
Potential Funding Sources	General Fund, State, federal, and private grant funding.
ACTION NO: 41	Improve railway crossing by installing barrier and warning signs along First Street on campus at California University.
Community: California Borough / California University	
Category	Structure and Infrastructure
Hazard(s) Addressed	Transportation Incident
Lead Agency/Department	California Borough & California University of PA
Implementation Schedule	N/A
Potential Funding Sources	General Fund, State, federal, and private grant funding.
ACTION NO: 42	Install flood alarms in basements of existing structures to monitor flooding.
Community: California Borough / California University	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	California Borough / California University of PA
Implementation Schedule	N/A
Potential Funding Sources	General Fund, State, federal, and private grant funding.
ACTION NO: 43	Develop flood maps and emergency operations plan for flooding on campus.
Community: California Borough / California University	
Category	Plans and Regulations
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam; Utility Interruption
Lead Agency/Department	California Borough / California University of PA
Implementation Schedule	N/A

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Potential Funding Sources	General Fund, State, federal, and private grant funding.
ACTION NO: 44	Work with Allegheny Health Network and the Washington County Department of Public Safety to provide North Strabane Police and Fire Departments with Narcan so they can provide care in field and to report opioid related incidents and track them to develop patterns.
Community: North Strabane Township	
Category	Plans and Regulations
Hazard(s) Addressed	Opioid Addiction and Response
Lead Agency/Department	North Strabane Township
Implementation Schedule	N/A
Potential Funding Sources	General Fund, State, federal, and private grant funding.
ACTION NO: 45	Strengthen grading ordinance and change slope requirements for all new structures.
Community: North Strabane Township	
Category	Plans and Regulations
Hazard(s) Addressed	Landslide
Lead Agency/Department	North Strabane Township Board of Supervisors, Township Manager and Township Contracted Engineer
Implementation Schedule	N/A
Potential Funding Sources	General Fund; State, federal, and private grant funding.
ACTION NO: 46	Work with mining companies to assess and repair damages.
Community: Carroll Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Mine Subsidence
Lead Agency/Department	North Strabane Township, Mining Company, PADEP
Implementation Schedule	N/A
Potential Funding Sources	Mine subsidence insurance
ACTION NO: 47	Update drainage, stabilize roadways, and stream embankments.
Community: Hopewell Township	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Hopewell Township Board of Supervisors, DCNR, PEMA, WCCD
Implementation Schedule	Ongoing
Potential Funding Sources	~$600,000; DCNR, DCNR DGLVR, PEMA
ACTION NO: 48	Repair damaged sidewalks.
Community: Bentleyville Borough	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Bentleyville Borough
Implementation Schedule	N/A
Potential Funding Sources	Grant Opportunities
ACTION NO: 49	Remove residue from Vision Creek.
Community: Bentleyville Borough	

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Bentleyville Borough
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 50	Improve storm drains to mitigate basement flooding.
Community: Bentleyville Borough	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Bentleyville Borough
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 51	Develop the "old slatements," to include remediation.
Community: Ellsworth Borough	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam
Lead Agency/Department	Ellsworth Borough
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 52	Acquire cost estimates and recommendations to update water pipes.
Community: Ellsworth Borough	
Category	Structure and Infrastructure
Hazard(s) Addressed	Flood, Flash Flood, Ice Jam; Utility Interruption
Lead Agency/Department	Ellsworth Borough, Engineering, EPA
Implementation Schedule	N/A
Potential Funding Sources	EPA
ACTION NO: 53	Track fire department gaps and look for partnering opportunities.
Community: South Franklin Township	
Category	Education and Awareness
Hazard(s) Addressed	All Hazards
Lead Agency/Department	South Franklin Township, North Franklin Township, Fire Department
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 54	Monitor trends and continue relationships with neighboring municipalities along Chartiers Creek.
Community: Green Hills Borough	
Category	Education and Awareness
Hazard(s) Addressed	All Hazards
Lead Agency/Department	Green Hills Borough, South Franklin Township, North Franklin Township, City of Washington, East Finley, Houston Borough, Canonsburg Borough, Cecil Township
Implementation Schedule	N/A

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Potential Funding Sources	N/A
ACTION NO: 55	Work to build awareness around vulnerabilities and vulnerable populations and communities, and work to make sure they are included and represented throughout the planning process. County will set up regular check ins with communities to discuss working with these underrepresented groups.
Community: Washington County, All Municipalities	
Category	Education and Awareness
Hazard(s) Addressed	All Hazards
Lead Agency/Department	Washington County Planning Commission and Department of Public Safety
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 56	Work with communities to adopt higher floodplain ordinance standards including setting the 0.2% chance (500 year) floodplain development requirements where the 1% chance (100 year) floodplain development requirements currently are.
Community: Washington County, All Municipalities	
Category	Education and Awareness
Hazard(s) Addressed	Flood
Lead Agency/Department	Washington County Planning Commission and Department of Public Safety
Implementation Schedule	N/A
Potential Funding Sources	N/A
ACTION NO: 57*	Coordinate with local dam owners and PADEP to obtain and digitize dam inundation data.
Community: Washington County, All Municipalities	
Category	Education and Awareness
Hazard(s) Addressed	Dam Failure
Lead Agency/Department	Washington County Planning Commission and Department of Public Safety, Local Officials
Implementation Schedule	Ongoing
Potential Funding Sources	FEMA HHPD Grant Program
ACTION NO: 58*	Collect and analyze data to determine dam risk impacts to vulnerable populations throughout the County for the purpose of integrating the information into County plans to inform decision making.
Community: Washington County, All Municipalities	
Category	Plans and Regulations
Hazard(s) Addressed	Dam Failure
Lead Agency/Department	Washington County Planning Commission and Department of Public Safety, Local Officials
Implementation Schedule	Ongoing
Potential Funding Sources	FEMA HHPD Grant Program
ACTION NO: 59	Consider subsidence-resistant design when developing in subsidence prone areas.
Community: All Municipalities	
Category	Structure and Infrastructure
Hazard(s) Addressed	Subsidence

Table 6.4-1 2021 Washington County Mitigation Action Plan	
Lead Agency/Department	Local Officials
Implementation Schedule	Ongoing
Potential Funding Sources	TBD

**Actions with an asterisks (*) next to the number are identified as actions that focus on reducing long-term vulnerabilities from HHPDs and align with goal 6 and objective 6.1, goal 1 and goal 2.*

Evaluating mitigation actions involves judging each action against certain criteria to determine its feasibility and potential impact. Actions evaluated and prioritized by applying the Multi-Objective Mitigation Action Prioritization criteria. For each action, scores were assigned to each criterion using the following weighted, multi-objective mitigation action prioritization criteria.

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

Scores of 1, 2, or 3 were assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. The Efficiency criterion, which considers the cost and effort of each action versus its overall vulnerability reduction benefit, is the most highly weighted criterion as part of the total prioritization score. Actions were prioritized using the cumulative score assigned to each. Each mitigation action was then given a priority ranking (Low, Medium, and High) based on the following:

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

Table 6.4-2 presents the cumulative results of the prioritization of mitigation actions. Ten actions were ranked High Priority, 34 are ranked Medium Priority, with the remaining 10 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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
1	Identify, acquire, and demolish structure with the highest relative vulnerabilities.	3	3	1	3	2	2.5	
2	Develop plans for potential hazards related to natural gas development.	3	2.5	1	3	3	2.5	
3	Community Outreach and Education regarding flood risk aimed at increasing individual mitigation actions including purchasing NFIP insurance and elevating utilities.	3	2	1	3	2.5	2.2	
4	Drainage System Maintenance along Ten Mile Creek.	3	3	1	3	1.5	2.4	
5	Encourage the municipalities to conduct annual reviews of zoning regulations meant to ensure a reduction in development in high hazard areas. The Washington County Planning Commission is responsible for reviewing subdivision and land development ordinances.	3	3	3	3	1	2.7	
6	Use information developed in the mitigation plan update process to update County and municipal comprehensive plans, especially where it relates to high hazard areas identified in this plan.	3	2	3	2	1	2.3	

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
7	Encourage all municipal offices to review the statewide Uniform Construction Code to ensure the enforcement of these codes as a minimum standard.	2	2	3	2	1	2.1	
8	Encourage applicable municipal offices to review their capital improvement plans to ensure that programmed infrastructure improvements are not in high hazard areas.	3	2	3	2	2	2.4	
9	Conduct annual reviews of County and municipal floodplain ordinances to ensure compliance with the NFIP.	3	2	1	2	2	2.0	
10	Conduct training as required to familiarize County and municipal staff with NFIP requirements, and the Community Rating System (CRS).	2	2	1	2	2	1.8	
11	Evaluate power requirements at shelters Countywide with the help of the American Red Cross (ARC) and take necessary steps to provide adequate backup power to those that need it.	2	2	2	1	2	1.9	
12	Create a committee to look at challenges associated with sheltering household pets in existing shelters.	2	2	2	1	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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
13	Undertake an education and outreach program meant to familiarize municipalities with subsidence insurance.	2	2	1	1	2	1.7	
14	Develop and maintain an asset list of repetitive loss properties, as well as structures located in the regulatory floodplain.	3	3	1	3	2	2.5	
15	Work with California University to maintain hazard maps to be used for future mitigation activities.	2	2	3	2	1	2.1	
16	Conduct public outreach to determine the interest of homeowners with repetitive loss properties in selling their properties as a hazard reduction measure. Annually apply for funds to conduct buyouts for interested homeowners.	2	2	1	2	2	1.8	
17	Maintain the "Storm Ready" status awarded by the National Weather Service. This is a biennial review and certification.	3	3	2	2	1	2.4	
18	Continue to collect information on potential mitigation grant applications projects including interested property owners, to be ready to apply for mitigation when funding is available.	3	2	3	3	1	2.4	

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
19	Coordinate with partner agencies to obtain relevant information for mitigation projects.	3	2	3	2	2	2.4	
20	Coordinate potential flood mitigation projects with Washington County officials, including watershed groups, and present projects or approval and funding; ongoing projects include identified stormwater management projects, creek bed reclamation, etc.	3	3	1	3	2	2.5	
21	Develop and maintain a list detailing the location of natural resource areas throughout the County. Use list to create maps and other relevant data for future mitigation activities.	2	2	3	2	2	2.2	
22	Conduct reviews of the 2010 stormwater management plan (phase II) and recreation plan for needed updates (if any).	2	2	1	3	2	2.0	
23	Coordinate with DEP, related conservation agencies, and watershed groups to research and identify flood control opportunities through restoration of reclaimed areas, i.e. open space, green space, etc.	2	2	1	3	2	2.0	

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
24	Create a variety of displays to be used at public events that cover topics including: mitigation, animals in disaster, business continuity and children's programs. These displays will appeal to different audiences and different events and can be supplemented with FEMA resources as handouts and giveaways.	2	2	3	3	2	2.4	
25	Maintain a list of media contacts to be used when release of hazard information is necessary.	2	2	3	2	2	2.2	
26	Develop a series of presentations that explain the hazards facing Washington County and how to best protect oneself from their effects. These presentations should be able to be tailored to different groups.	2	2	3	2	2	2.2	
27	Coordinate with the ARC to ensure that educational opportunities are presented on a regular basis.	2	2	3	3	2	2.4	
28	Update the WCDPS website. Update is to include information on all 4 phases of emergency management, as well as presenting current weather, stream level data, iFLOWs data and any other pertinent warning information.	3	2	3	3	2	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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
29	Identify local spaces willing to display and distribute information to citizens on topics like: preparedness, NFIP, FIRMs, etc.	2	2	3	2	2	2.2	
30	Establish a program that contacts those living in structures located within the regulatory floodplain and provides information related to flood safety, flood insurance, and property protection measures, including elevation.	2	2	1	3	2	2.0	
31	Encourage the tax assessment office to continue compiling information on structures located in the regulatory floodplain, as well as those that have a history of flood losses.	2	2	1	3	2	2.0	
32	Develop grant applications to suitably protect repetitive-loss properties 1% annual chance floodplain (for owners interested in FEMA mitigation funding), including through elevation.	3	3	1	3	1	2.3	
33	Develop grant applications to suitably protect and continue operations of critical facilities in the 1% annual chance floodplain, including through wet and dry floodproofing.	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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
34	Develop project inventory and grant applications to suitably protect infrastructure from the effects of rockslides and road slip.	3	2	1	2	2	2.0	
35	Design and implement storm drain system to handle the rainwater along the length of Wesley Avenue, and the drainage area above the roadway.	3	1.5	1	3	2	2.3	
36	Conduct stream bank stabilization to stop erosion before structural integrity of the headwall at Reservoir #2 is compromised.	3	2	2	2	3	2.4	
37	Floodplain restoration on Chartiers Creek including sediment removal.	3	2	1	3	1	2.3	
38	Stream bank and flood plain restoration on Chartiers Creek. Actions include cutting stream banks back to correct angles, stabilization with native plantings, removal of sedimentation on stream bank, and planting a riparian buffer along 750 feet of Chartiers Creek.	2	3	1	2	1	1.8	
39	Update the Emergency Operations Plan for pandemic preparedness and response. This process includes identifying equipment needed and needed policy for future pandemic events.	2	3	1	1	1	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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
40	Create and distribute, on campus and elsewhere, educational materials about railway crossing safety.	2	3	1	1	1	1.6	
41	Improve railway crossing by installing barrier and warning signs along First Street on campus at California University.	3	2	1	1	1	2	
42	Install flood alarms in basements of existing structures to monitor flooding.	2	2	2	3	3	2.5	
43	Develop flood maps and emergency operations plan for flooding on campus.	2	3	2	3	2	2.4	
44	Work with Allegheny Health Network and the Washington County Department of Public Safety to provide North Strabane Police and Fire Departments with Narcan so they can provide care in field and to report opioid related incidents and track them to develop patterns.	3	3	1	1	1	1.8	

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE
45	Strengthen grading ordinance and change slope requirements for all new structures.	3	3	1	3	1	2.6
46	Work with mining companies to assess and repair damages.	2	2	1	3	2	2.0
47	Update drainage, stabilize roadways, and stream embankments.	3	2	2	2	2	2.2
48	Repair damaged sidewalks.	2	1	1	1	3	1.6
49	Remove residue from Vision Creek.	3	2	1	3	3	2.4

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
50	Improve storm drains to mitigate basement flooding.	3	2	2	3	2	2.4	
51	Develop the "old slatements," to include remediation.	1	1	1	1	1	1	
52	Acquire cost estimates and recommendations to update water pipes.	3	2	2	1	2	2	
53	Track fire department gaps and look for partnering opportunities.	3	3	3	3	3	3	
54	Monitor trends and continue relationships with neighboring municipalities along Chartiers Creek.	2	2	1	3	2	2	

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	ADDRESSED HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIOS /INFRASTRUCTURE	TOTAL SCORE	
55	Work to build awareness around vulnerabilities and vulnerable populations and communities, and work to make sure they are included and represented throughout the planning process. County will set up regular check ins with communities to discuss working with these underrepresented groups.	1	2	3	2	1	1.85	
56	Work with communities to adopt higher floodplain ordinance standards including setting the 0.2% chance (500 year) floodplain development requirements where the 1% chance (100 year) floodplain development requirements currently are.	1	1	1	2	1	1.15	
57	Coordinate with local dam owners and PADEP to obtain and digitize dam inundation data.	1	1	1	2	2	1.3	
58	Collect and analyze data to determine dam risk impacts to vulnerable populations throughout the County for the purpose of integrating the information into County plans to inform decision making.	1	1	1	2	2	1.3	
59	Consider subsidence-resistant design when developing in subsidence prone areas.	1	1	1	1	1	1	

7. Plan Maintenance

7.1. Update Process Summary

Once this Plan has received approval from PEMA and ultimately FEMA, the Plan will be adopted by the Washington County and all participating jurisdictions. This HMP Update is intended to be a 'living document'. Plan adoption is not considered the final step in the planning process but rather as a first step to 'realization'. The plan monitoring and maintenance schedule is a cycle of events that involve periodic review, adjustments, and improvement. Plan monitoring also provides an opportunity to recognize other planning initiatives within the County that may benefit from the incorporation of risk and/or mitigation objectives detailed in the HMP. This section establishes a method to monitor how the Plan will be evaluated and maintained in the future.

7.2. Monitoring, Evaluating, and Updating the Plan

In order to ensure that the Plan continues to provide a framework of reducing risk in Washington County Emergency Management Agency, will take responsibility to convene an annual meeting of the HMPT with strong support from the Washington County Department of Planning & Zoning. The HMPT is comprised of County and municipal officials involved in the preparation of the Plan Update as well as other relevant stakeholder representatives that participated in the planning process.

The Hazard Risk table will be reviewed and any changes to rankings based on frequency or severity to profiled hazards will be documented. Municipal officials will be asked to provide a mitigation action progress information each year and the Mitigation Action Plan will be updated accordingly. The HMPSC will prepare an annual update report of the mitigation actions based on the annual report forms from the municipalities as well as the County. The annual HMP review will be scheduled each year during the week of the HMP approval anniversary. The following questions will be considered as criteria for assessing the effectiveness of the HMP:

- Has the nature or magnitude of hazards affecting the County changed?
- Are there new hazards that have the potential to impact the County?
- Is there updated, or more quantitative, risk assessment data available related to the identified hazards in the plan? Can this data be integrated into the analysis to better assess the vulnerability, and depict the risk, of communities to the hazards?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?

- Are there current or upcoming planning mechanisms or initiatives in which the mitigation strategy should be considered for integration?

In addition to conducting an annual review of the Plan, the HMPSC will review the Plan within 30 days of a disaster. The Risk Assessment and Mitigation Strategy will be evaluated and any changes to community priorities or status will be documented. The HMP will receive a full, detailed update every five years, as required to reflect the current risk, vulnerabilities, development trends and as mitigation actions are implemented. While an annual report will be completed each year, any state and Federal mandates from PEMA and FEMA respectively, will be addressed in the five-year update. The municipalities will not be responsible for making any changes to the HMP document as part of annual reviews; their role will consist of information the review and report only. A copy of each Annual Plan Review will be provided to PEMA and FEMA and included as official documentation in the next 5-year HMP update.

7.3. Continued Public Involvement

As was done during development of the 2021 HMP, the HMPT will involve the public during annual review periods by providing an opportunity to review and submit feedback. The public will have access to the current HMP through their local municipal office or on the Washington County government website.

The Comprehensive Plan; Capital Improvements Program; Building Code, Municipal Floodplain Management Regulations, Emergency Operations Plan, and Zoning Ordinance are identified for incorporation of hazard mitigation actions once the Plan is adopted. Each of these mechanisms will continue to be used to meet the intent of this Plan, as appropriate. Likewise, as these planning mechanisms are updated, they will be considered for incorporation into the HMP during the annual review process and/or the five-year cycle update.

The County and participating jurisdictions may propose additional mitigation actions for inclusion throughout the five-year cycle but must submit new mitigation actions through the Emergency Management Agency which will request an HMP amendment by contacting the PEMA State Hazard Mitigation Planner. FEMA must officially approve all additions and will amend the HMP by issuing an HMP Amendment Approval letter.

8. Plan Adoption

The Plan was submitted to the Pennsylvania State Hazard Mitigation Planner on _____, 2021.

This section of the plan includes copies of the local adoption resolutions passed by Washington County and its municipal governments as well as a completed Local Mitigation Plan Review Crosswalk. Adoption resolution templates are provided to assist the County and municipal governments with recommended language for future adoption of the HMP.

Washington County 2021 Hazard Mitigation Plan

County Adoption Resolution

Resolution No. _____

Washington County, Pennsylvania

WHEREAS, the municipalities of Washington 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, Washington 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 Washington County 2020 Hazard Mitigation Plan has been developed by the Washington County Emergency Management Agency in cooperation with the Washington County Department of Planning & Zoning, other County departments, local municipal officials, institutional stakeholders, and the citizens of Washington County.

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Washington County 2021 Hazard Mitigation Plan, and

WHEREAS, the Washington County 2021 Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the County of Washington that:

- The Washington County 2021 Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the County, and
- The respective officials and agencies identified in the implementation strategy of the Washington County 2021 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: **WASHINGTON COUNTY**

_____ By _____

By _____

By _____

Washington County 2021 Hazard Mitigation Plan

Municipal Adoption Resolution

Resolution No. _____

< Municipality Name>, Washington County, Pennsylvania

WHEREAS, the *<Borough/Township of Municipality Name>*, Washington 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 Washington County 2021 Hazard Mitigation Plan has been developed by the Washington County Department of Planning & Zoning in cooperation with Washington County Emergency Management Agency, other County departments, local municipal officials, institutional stakeholders, and the citizens of Washington County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Washington County 2021 Hazard Mitigation Plan, and

WHEREAS, the Washington County 2021 Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the *< Municipality Name>*:

- The Washington County 2021 Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the *<Borough/Township/City>*, and
- The respective officials and agencies identified in the implementation strategy of the Washington County 2021 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: **< MUNICIPALITY NAME>**

_____ By _____

By _____

By _____