Lycoming County 2015 Hazard Mitigation Plan Update

Prepared for:
Lycoming County Planning & Community Development
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with support from PEMA

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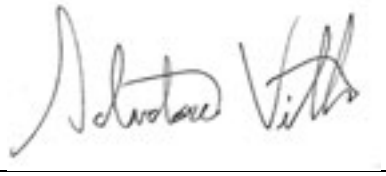
Lycoming County Hazard Mitigation Plan Update

Certification of Annual Review Meetings

The Lycoming County Hazard Mitigation Steering Committee has reviewed this Hazard Mitigation Plan Update. See Section 7 of the Lycoming County 2015 Hazard Mitigation Plan Update for further details regarding this form. The Hazard Reduction Planner of the Lycoming County Planning and Community Development Department hereby certifies the review.

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED?*	SIGNATURE
2011	9/7/2011	Yes, Public Meeting	
	11/16/2011	No	
	12/6/2011	Yes, Public Meeting	
	12/12/2011	Yes, Public Meeting	
	12/15/2011	Yes, Public Meeting	
2012	1/25/2012	Yes, outreach methodology covered	
2013			
2014			
2015			
2016			

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

Lycoming County Hazard Mitigation Plan Update

Record of Changes

DATE	DESCRIPTION OF CHANGE MADE, MITIGATION ACTION COMPLETED, OR PUBLIC OUTREACH PERFORMED	CHANGE MADE BY (PRINT NAME)	CHANGE MADE BY (SIGNATURE)
9/7/2011	Public Meeting held to discuss the Hazard Mitigation Grant Program and flood mitigation projects following Tropical Storm Sandy	No Changes to the HMP. Documentation included in Appendix B.	
12/6/2011	Public Meeting held to discuss the Hazard Mitigation Grant Program and flood mitigation projects following Tropical Storm Sandy	No Changes to the HMP. Documentation included in Appendix B.	
12/12/2011	Public Meeting held to discuss the Hazard Mitigation Grant Program and flood mitigation projects following Tropical Storm Sandy	No Changes to the HMP. Documentation included in Appendix B.	
12/15/2011	Public Meeting held to discuss the Hazard Mitigation Grant Program and flood mitigation projects following Tropical Storm Sandy	No Changes to the HMP. Documentation included in Appendix B.	
1/25/2012	Discovery meeting held as part of RiskMAP that included information about Mitigation Planning and Community Assistance, a description of Mitigation, an overview of the 2010 HMP and the HMGP, as well as risk communication and the Community Rating System.	No Changes to the HMP. Documentation included in Appendix B.	

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

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1. Introduction

1.1. Background

Across the United States, natural and human-caused disasters have led to increasing levels of deaths, injuries, property damage, and interruption of business and government services. The time, money, and efforts to recover from these disasters exhaust resources, diverting attention from important public programs and private agendas. With 53 Presidential Disaster Declarations and nine Presidential Emergency Declarations in Pennsylvania, 13 and five of which have included Lycoming County. The emergency management community, citizens, elected officials, and other stakeholders in Lycoming County, Pennsylvania, recognized the impact of disasters on their community and concluded that proactive efforts were needed to reduce the impact of natural and human-caused hazards.

Federal and state governments have utilized mitigation concepts to minimize environmental degradation and to reduce loss of life and property associated with natural hazards. However, mitigation was most often applied in a post-disaster environment. In an effort to increase public awareness and to reduce the costs associated with disaster preparedness, the Federal Emergency Management Agency (FEMA) developed a National Mitigation Strategy. The National Mitigation Strategy was an outgrowth of changing perceptions of hazards and their relationship to development. It represents a sustained effort to reduce hazard vulnerabilities through public outreach and partnership development, and was created with input from federal agencies, state and local governments, and the general public.

Hazard mitigation is a phrase that describes actions taken to prevent or reduce the long-term risks to life and property from hazards. Pre-disaster mitigation actions are taken in advance of a hazard event and are essential to breaking the typical disaster cycle of damage, reconstruction, and repeated damage. With careful selection, mitigation actions can be long-term, cost-effective means of reducing the risk of loss.

Accordingly, the Lycoming County Hazard Mitigation Steering Committee and watershed planning groups, composed of County officials, municipal representatives, emergency responders, and business leaders, has updated this Hazard Mitigation Plan (HMP). The update was sponsored by the Pennsylvania Emergency Management Agency (PEMA). As part of this process, PEMA contracted with Michael Baker, Jr., Inc. (Baker) to coordinate the planning process and plan update. The HMP update is the result of four months of work by the citizens and officials of the County and representatives from Baker to develop a pre-disaster multi-hazard mitigation plan that will not only guide the County toward greater disaster resistance, but will also respect the character and needs of the community.

1.2. Purpose

This Hazard Mitigation Plan Update was developed for the purpose of:

- Protecting life, safety, and property by reducing the potential for future damages and economic losses that result from natural hazards';
- Qualifying for additional grant funding, in both the pre-disaster and the post-disaster environment;

- Qualifying for additional credit under the Community Ratings System (CRS);
- Speeding recovery and redevelopment following future disaster events;
- Demonstrating a firm local commitment to hazard mitigation principles; and
- Complying with both state and federal legislative requirements for local hazard mitigation plans.
- Improving community resiliency following a disaster event.

1.3. Scope

The implementation actions within this HMP apply to Lycoming County and any municipalities that adopt this HMP as their own. However, only those municipalities that have participated in the plan update process will remain eligible for state and federal hazard mitigation funding through the HMP. For the purpose of this plan update, municipal participation was defined as completion and submission of a Risk Assessment Update Worksheet and Capability Assessment Survey, and attendance by a municipal official at a planning or public meeting conducted as part of the planning process.

1.4. Authority and References

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended;
- Code of Federal Regulations (CFR), Title 44, Parts 201 and 206;
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended; 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 Federal Emergency Management Agency (FEMA) guides and reference documents were used to prepare this document:

- FEMA 386-1: *Getting Started*. September 2002.
- FEMA 386-2: *Understanding Your Risks: Identifying Hazards and Estimating Losses*. August 2001.
- FEMA 386-3: *Developing the Mitigation Plan*. April 2003.
- FEMA 386-4: *Bringing the Plan to Life*. August 2003.
- FEMA 386-5: *Using Benefit-Cost Review in Mitigation Planning*. May 2007.
- FEMA 386-6: *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*. May 2005.
- FEMA 386-7: *Integrating Manmade Hazards into Mitigation Planning*. September 2003.
- FEMA 386-8: *Multijurisdictional Mitigation Planning*. August 2006.

- FEMA 386-9: *Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects*. August 2008.
- FEMA. *Local Mitigation Planning Handbook.* March 2013.
- FEMA. *Local Mitigation Plan Review Guide.* October 1, 2011.
- FEMA *National Fire Incident Reporting System 5.0: Complete Reference Guide*. January, 2008.
- FEMA Hazard Mitigation Assistance Unified Guidance. September 11, 2013.
- FEMA. Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials. March 1, 2013
- FEMA. Mitigation Ideas. A Resource for Reducing Risk to Natural Hazards. January 2013.

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

- PEMA Hazard *Mitigation Planning Made Easy!*
- PEMA Mitigation Ideas: *Potential Mitigation Measures by Hazard Type; A Mitigation Planning Tool for Communities*. March 6, 2009.
- PEMA Pennsylvania's *Hazard Mitigation Planning Standard Operating Guide*. October, 2013.

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

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

2. Community Profile

2.1. Geography and Environment

Situated in North-central Pennsylvania at the convergence of two geomorphologic provinces - the Allegheny Plateau and the Valley and Ridge province - Lycoming County boasts a scenic landscape characterized by steep slopes, deep river valleys, and abundant forestland. At 1,246 square miles, Lycoming is the largest of Pennsylvania's 67 counties, equivalent in size to the state of Rhode Island. Figure 2.1-1 provides an outline of Lycoming County.

The County of Lycoming lies entirely within the Susquehanna River Basin, one of four major drainage basins in Pennsylvania. Over 2,200 miles of streams traverse the County, whose fertile valleys were settled long before land use controls and floodplain regulations were in place. The County's most populated watershed is the West Branch of the Susquehanna River, which flows throughout the County for a distance of 38 miles. Major tributaries of the West Branch include Pine Creek, Little Pine Creek, Larry's Creek, Lycoming Creek, Loyalsock Creek, Muncy Creek, Little Muncy Creek, White Deer Hole Creek, and Antes Creek. Several of these tributaries comprise watersheds that have been designated "exceptional and high quality" watersheds by the Pennsylvania Environmental Quality Board. Figure 2.1-2 shows the County's Watershed Outreach Groups (WOG) and Table xxx lists the WOGs and corresponding HUC 10 Watersheds. The County's six major watersheds are described as follows:

Pine Creek Watershed – Historically an area of low population density, Pine Creek Watershed, comprised mainly of recreation areas accounts for a low portion of Lycoming County's total population. A majority of the watershed's land acreage is designated state forest, game lands, and wild or natural areas. Furthermore, the close proximity of several major transportation corridors to meandering creek beds has created a localized flood hazard. Several times a year, Pine Creek overtops its banks, forcing the closure of S.R. 414. Although private properties have rarely sustained water damage, flooding along S.R. 414 has impaired emergency service delivery on several occasions. The meandering nature of Little Pine Creek poses a threat to the village of English Center. A state-owned suspension bridge may be at risk if the creek continues to erode its banks during high-water events.

Larry's Creek Watershed – Larry's Creek Watershed drains an 89-square-mile area in western Lycoming County. The landscape is predominately forested and characterized by narrow valleys and steep wooded hillsides. Larry's Creek forms in Cogan House Township and flows southwesterly to its mouth on the West Branch Susquehanna River.

Lycoming Creek Watershed – Next to the West Branch Susquehanna, the Lycoming Creek Watershed is the most densely populated watershed in the County. While the City of Williamsport has lost population over the last 20 years, communities throughout the basin have witnessed some new development. Sanitary sewer lines were extended north along Lycoming Creek Road, and a new limited-access highway, both signs that the County is focusing growth in this area.

Loyalsock Creek Watershed – Five townships comprise the bulk of the population in this watershed: Upper Fairfield Township, Eldred Township, Gamble Township, Plunkett's Creek Township, and Cascade Township. Loyalsock Creek begins in the western edge of Wyoming County and flows for 60 miles until it reaches its mouth at the West Branch Susquehanna River in Montoursville Borough. It drains a region 494 square miles in area.

Muncy Creek Watershed – Muncy Creek is 33 miles long and drains a 216-square-mile area that encompasses parts of Sullivan, Columbia, Montour, and Lycoming Counties. The upper reaches of the drainage basin are relatively rough, forested areas, while the lower reaches consist of rolling topography and broad agricultural lands.

West Branch Susquehanna Watershed – The most heavily populated areas of the County can be found along its southern extent, trailing the West Branch of the Susquehanna River. The West Branch Susquehanna is one of six major sub-basins of the Susquehanna River, the largest tributary of the Chesapeake Bay. Although not the most developed, it is the largest sub-basin, draining an area some 6,992 square miles in extent. Agriculture and urban land uses predominate in the eastern and southern areas. The entire sub-basin supports a population of nearly 400,000, with major population centers in State College, Lock Haven, and Williamsport

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Figure 2.1-1 Base Map of Lycoming County.

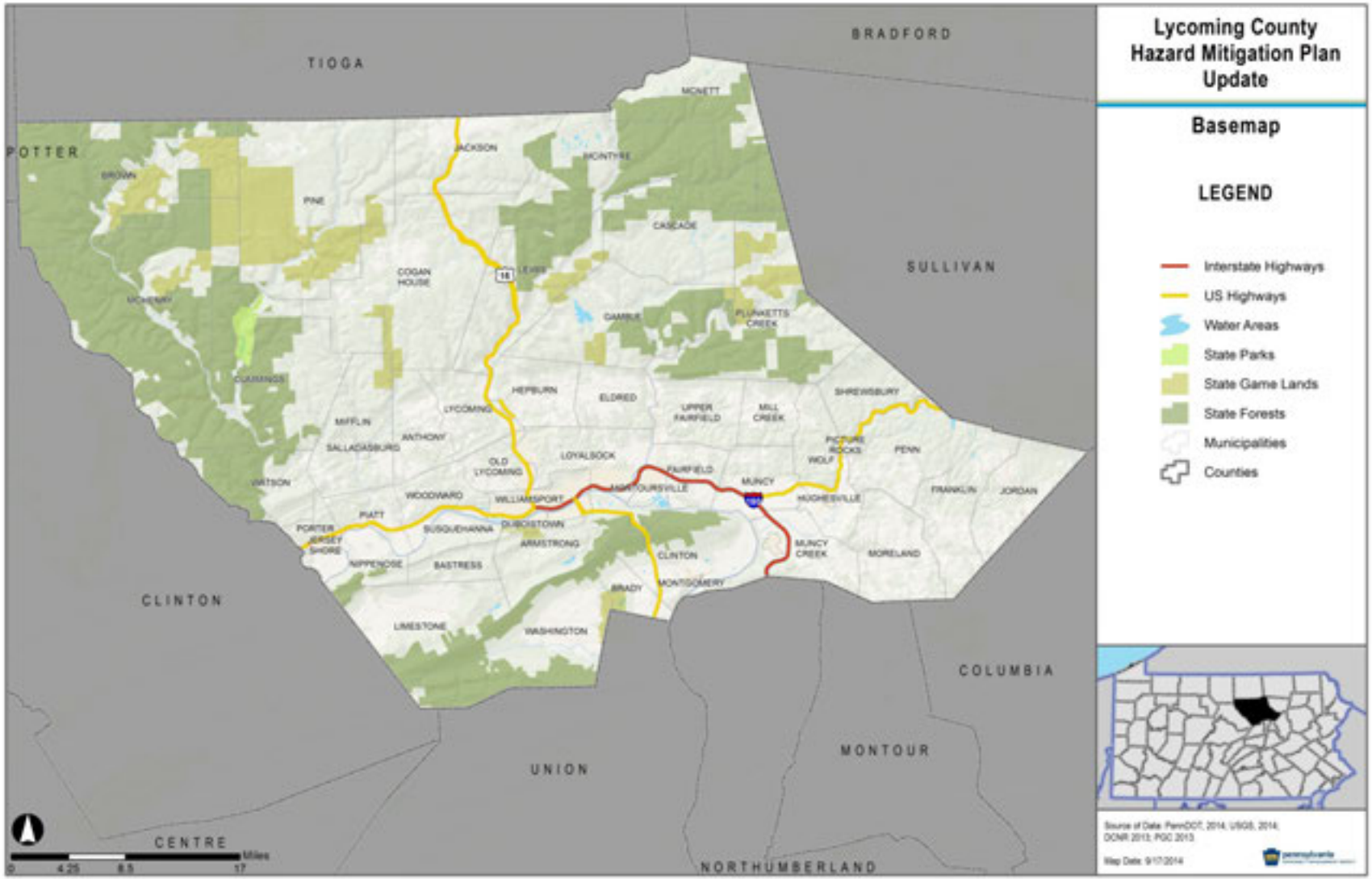


Figure 2.1-2 Lycoming County Watersheds and WOGs.

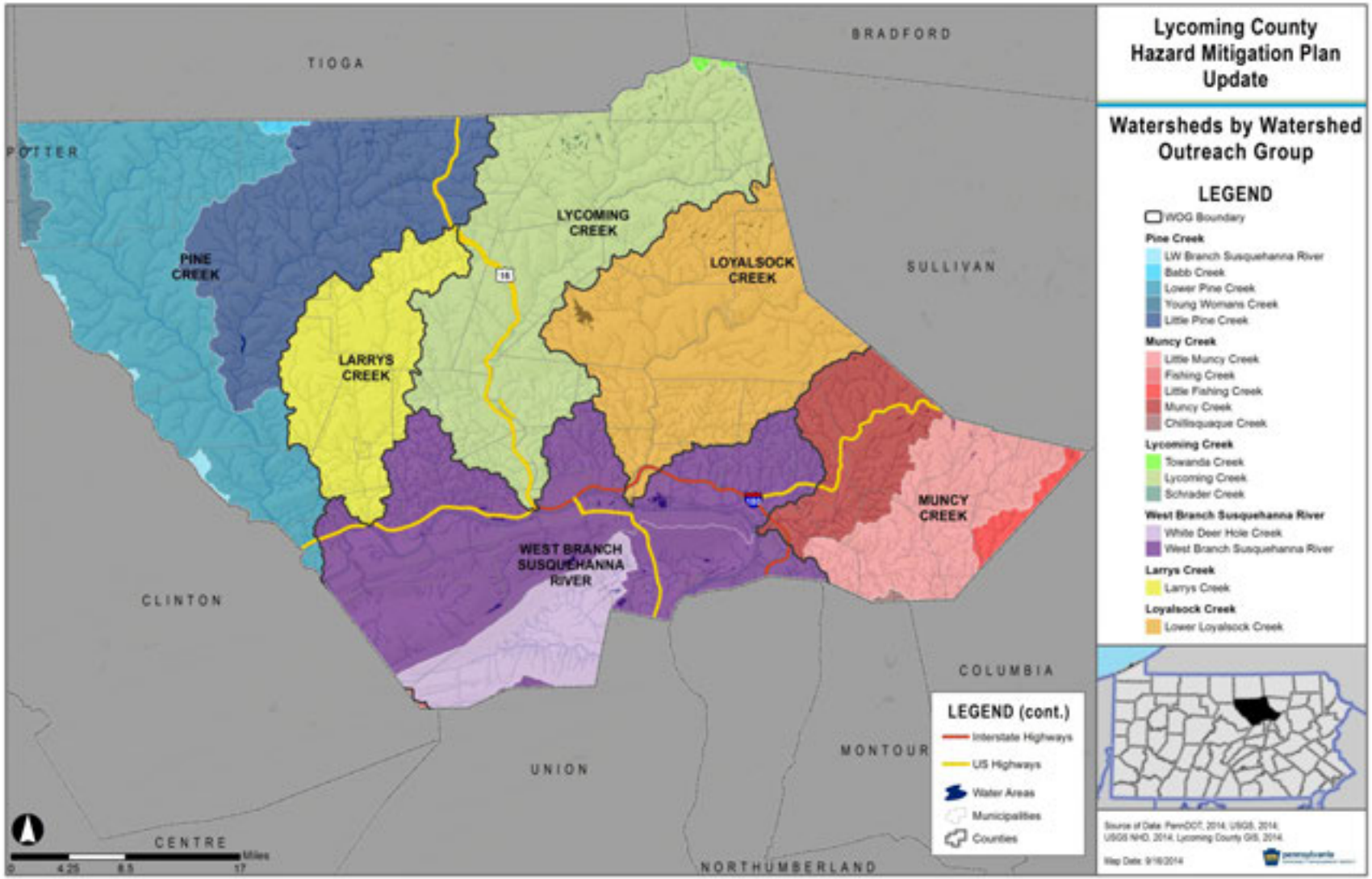


Table 2.1-1 Watershed Outreach Groups (WOG) and corresponding HUC 10 watersheds		
WOG	**HUC 10**	**HUC 10 NAME**
Larrys Creek	205020601	Larrys Creek
Loyalsock Creek	205020605	Lower Loyalsock Creek
Lycoming Creek	205010602	Schrader Creek
	205010603	Towanda Creek
	205020602	Lycoming Creek
Muncy Creek	205010706	Little Fishing Creek
	205010707	Fishing Creek
	205020607	Little Muncy Creek
	205020608	Muncy Creek
	205020611	Chillisquaque Creek
Pine Creek	205020303	Young Womans Creek
	205020304	Lower West Branch Susquehanna River
	205020504	Babb Creek
	205020505	Little Pine Creek
	205020506	Lower Pine Creek
West Branch Susquehanna River	205020403	Fishing Creek
	205020609	White Deer Hole Creek
	0205020612; 0205020606	West Branch Susquehanna River

2.2. Community Facts

Despite its rural location, the County is quite accessible from urban areas throughout the Susquehanna River Valley. As Figure 2.1-1 illustrates, U.S. Route 15 provides access to points north and south while Interstate 180 and U.S. Route 220 link the County with Interstate 80, a major east-west trending highway that extends from New Jersey to the Ohio state line. The County is comprised of 52 municipalities, including 42 townships, 9 boroughs, and the City of Williamsport, the metropolitan center and County seat.

2.3. Population and Demographics

Population and demographic information provide baseline information about residents. Changes in demographics or populations may be used to identify higher-risk populations. Maintaining up-to-date data on demographics will allow the County to better assess magnitudes of hazards and develop more specific mitigation plans. Baseline demographic information for Lycoming County is provided in Table 2.3-1.

Table 2.3-1 Lycoming County Demographic Summary (U.S. Census)		
DEMOGRAPHIC DATA POINT	**2000**	**2010**
Total Population	120,044	116,111
Male/Female	58,682/61,362	56,839/59,272

Median Age (years)	38.4	41.1
Under 5 years	6,601	6,449
5 – 19 years	25,294	21,884
20 – 64 years	68,898	68,666
65 years and older	19,251	19,112

Lycoming County has an estimated 2013 population of 116,754, making Lycoming the most populated county in the Pennsylvania Wilds region, which consists of Lycoming, Clearfield, Clinton, Cameron, Warren, McKean, Jefferson, Potter, Tioga, Clarion, Elk, and Forest Counties. Clearfield, with a population of approximately 81,642, has the next largest population in the region.

Table 2.3-3 provides the total population for each jurisdiction in Lycoming County for years 2000 and 2010. As seen in the table, much of Lycoming County's population can be attributed to the City of Williamsport. The City of Williamsport had a total population of approximately 29,349 in 2013. The Williamsport Metropolitan Statistical Area (MSA) consists of all of Lycoming County and therefore, also has an estimated population of 116,754 in 2013. The two closest MSAs to the Williamsport MSA are the Scranton-Wilkes Barre-Hazelton MSA to the east and the State College MSA to the west of Lycoming County. Both MSAs are larger than the Williamsport MSA. In 2013, the Scranton-Wilkes Barre-Hazelton MSA, made up of Lackawanna; Luzerne; and Wyoming Counties; had a population of approximately 562,037. The State College MSA, comprised of just Centre County, had an approximate population of 155,403 in 2013.

Over 16 percent of Lycoming County's population is 65 or older. These residents may have special needs. For example, many may be unable to drive; therefore, special evacuation plans may need to be created for them. They may also have hearing or vision impairments which could make receiving emergency instructions difficult. Both older and younger populations have higher risks for contracting certain diseases. Lycoming County's combined under 5-years-of-age and over-65 populations represent approximately 22 percent of its population.

Population estimates done for the County 2006 Comprehensive Plan show that the County should reach a population of 122,859 by 2020. However, more recent population projections, based on 2010 Census data, show that Lycoming County is expected to lose population. Census based projections estimate that the County's population will be 112,179 in 2040, with a steady decline occurring after 2010. A deeper discussion of this expected population loss, and its impacts on future development, risk, and vulnerability is discussed in Section 4.4.4.

Table 2.3-2 displays the housing characteristics for Lycoming County. In 2010, Lycoming County had 52,500 residential units. These properties may be vulnerable to various natural hazards, in particular, flooding and windstorms. Damage to residential properties is not only expensive to repair or rebuild, but also devastating to the displaced family. Meanwhile, approximately 11 percent of the County's residential properties are vacant. Vacant buildings are particularly vulnerable to arson and criminal activity. Since many vacant properties may not

have been maintained, they may be structurally deficient and at risk of collapsing during a hazard event.

Table 2.3-2 Housing Characteristics (U.S. Census, 2000 and 2010 SF1 datasets).

HOUSING CHARACTERISTIC	2000	2010
Total Housing Units	52,464	52,500
Occupied Housing Units	47,003	46,700
Vacant Housing Units	5,461	5,800
Owner-Occupied Housing Units	32,636	31,821
Renter-Occupied Housing Units	14,357	14,879
Median Home Value [(1)]	$86,200	$127,000

[(1)] Questions pertaining to home value were not included in SF1 Datasets; therefore, American Community Survey 2010 1-Year Estimates and Census 2000 SF 3 were used.

Table 2.3-3 Municipal Population in Lycoming County (US Census).		
MUNICIPALITY	US CENSUS POPULATION	
	2000	2010
BOROUGHS		
Duboistown	1,280	1,205
Hughesville	2,220	2,128
Jersey Shore	4,482	4,361
Montgomery	1,695	1,579
Montoursville	4,777	4,615
Muncy	2,663	2,477
Picture Rocks	693	678
Salladasburg	260	238
South Williamsport	6,412	6,379
Williamsport	30,706	29,381
TOTAL: Boroughs	*55,188*	*53,041*
TOWNSHIPS		
Anthony	904	865
Armstrong	717	681
Bastress	574	546
Brady	1,351	521
Brown	111	96
Cascade	419	413
Clinton	3,090	3,708
Cogan House	974	955
Cummings	355	273
Eldred	2,178	2,122
Fairfield	2,659	2,792
Franklin	915	933
Gamble	854	756
Hepburn	2,836	2,762
Jackson	414	396
Jordan	878	863
Lewis	1,139	987
Limestone	2,136	2,019
Loyalsock	10,876	11,026
Lycoming	1,606	1,478
McHenry	145	143
McIntyre	539	520
McNett	211	174
Mifflin	1,145	1,070
Mill Creek	572	604
Moreland	1,036	943
Muncy Creek	3,487	3,474
Muncy	1,059	1,089
Nippenose	729	709
Old Lycoming	5,508	4,938

Table 2.3-3 Municipal Population in Lycoming County (US Census).		
MUNICIPALITY	**US CENSUS POPULATION**	
	2000	**2010**
Penn	900	960
Piatt	1,259	1,180
Pine	329	294
Plunketts Creek	771	684
Porter	1,633	1,601
Shrewsbury	433	409
Susquehanna	993	1,000
Upper Fairfield	1,854	1,823
Washington	1,613	1,619
Watson	550	537
Wolf	2,707	2,907
Woodward	2,397	2,200
TOTAL: Townships	*64,856*	*63,070*
Lycoming County	**120,044**	**116,111**

Approximately 32 percent of the County's population rent. Renters are more transient than home owners; therefore, communicating with renters may be more difficult than with home owners. Similarly, tourists would be a harder population to communicate with during an emergency event. Communication strategies should be developed to ensure that these populations can be given proper notification. Additionally, approximately 3 percent of Lycoming County's population speaks a language other than English. Hazard mitigation strategies will need to address language barriers to ensure that all residents can receive emergency instructions.

As displayed in Table 2.3-4, the 2013 estimated median household income in the County is $47,373, which is lower than the Commonwealth of Pennsylvania's median household income of $52,007. The County's per capita income of $24,319 is also lower than the Commonwealth's per capita income of $28,647.

Table 2.3-4 Income Levels & Wage Statistics (U.S. Census, ACS 2010 and 2013 Estimates; PA Department of Labor & Industry, Labor Market Statistics, Quarterly Census of Employment and Wages).				
INCOME	**LYCOMING COUNTY**		**PENNSYLVANIA**	
	2010	**2013 ESTIMATES[(1)]**	**2010**	**2013 ESTIMATES [(1)]**
Median Household Income	41,037	47,373	49,288	52,007
Median Family Income	49,997	56,611	61,890	66,522
Per Capita Income	20,146	24,319	26,374	28,647
WAGES (1ST QUARTER 2014)	**LYCOMING COUNTY**		**PENNSYLVANIA**	
Average Weekly Wage	$778		$1,007	
Average Annual Wage (2013)	$39,540		$49,077	

2.4. Land Use and Development

Lycoming County is mostly rural with the majority of its population located in the south-central area of the County, centered along the West Branch of the Susquehanna River and U.S. Route 15, Interstate 180, and U.S. Route 220. Figure 2.4-3 shows the current pattern of land use in the County by displaying the property type of the County's parcels as of 2014. The County's vision for future development, as documented in the 2006 Comprehensive Plan, is to keep growth centralized and protect its natural resource areas in the outer regions while steering development outside of flood prone areas. Figure 2.4-2 reflects this goal. To do so, the County has designated growth areas where the County will target economic development activity. These growth areas, which can be seen in Figure 2.4-2, are focused on development around Interstate 180, U.S. Route 15, U.S. Route 220, the future development of Interstate 99, and the Greater Williamsport, Montoursville, Muncy, and Lower Lycoming Creek communities. Six multi-jurisdictional planning regions, along with the desired development within each region, have been identified to help guide this development. The six planning regions are as follows: the Greater Williamsport Alliance Planning, Lower Lycoming Creek Planning Area, Montoursville-Muncy Planning Area, Muncy Creek Planning Area, US 15 South Planning Area, and the US 220/Future I-99 Planning Area.

The County has many land development regulations in place to protect its natural, historic, and environmentally sensitive areas. Figure 2.4-1 shows municipalities and Zoning and Subdivision Ordinances. Several municipalities have chosen to adopt the County Zoning and Subdivision Ordinance which also contains floodplain management regulations. These regulations for floodplain management exceed federal standards and are described in detail in Section 5.2.1. For more information on how future development patterns impact vulnerability to hazards, please see Section 4.4.4.

Figure 2.4-1 **Lycoming County Ordinances by Municipality (Lycoming County GIS, 2014).**

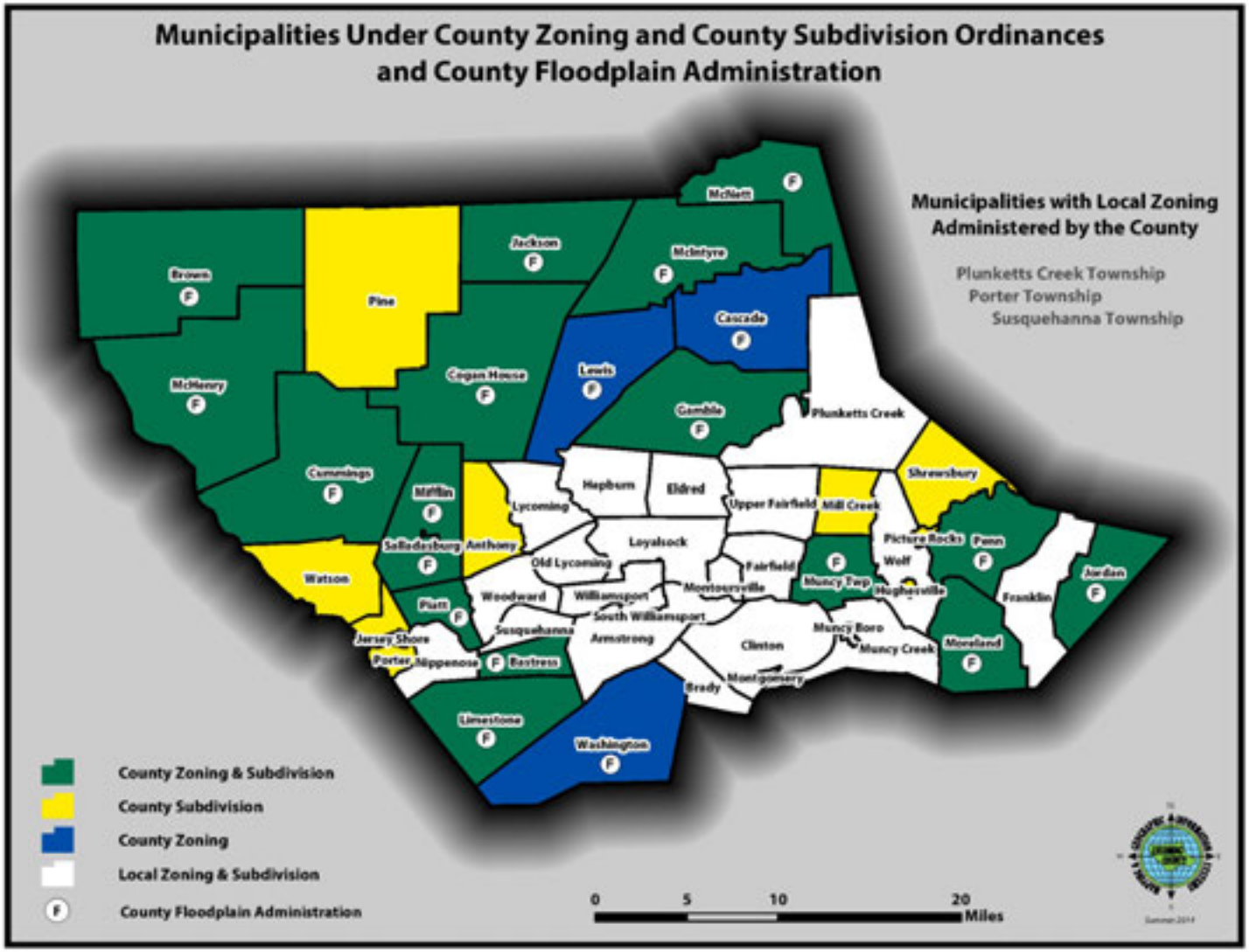


Figure 2.4-2 Lycoming County planning areas for growth (Lycoming County 2006 Comprehensive Plan).

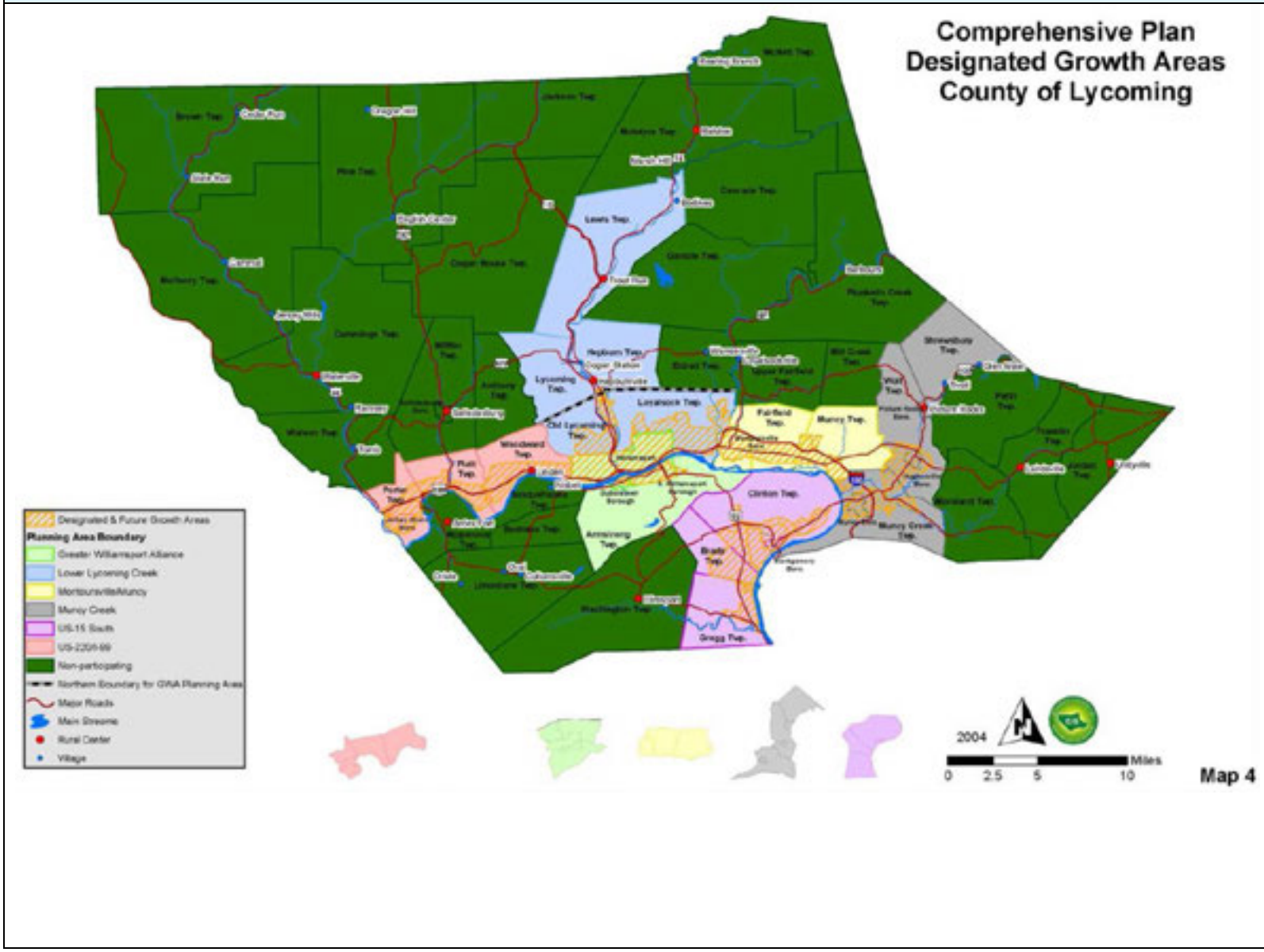
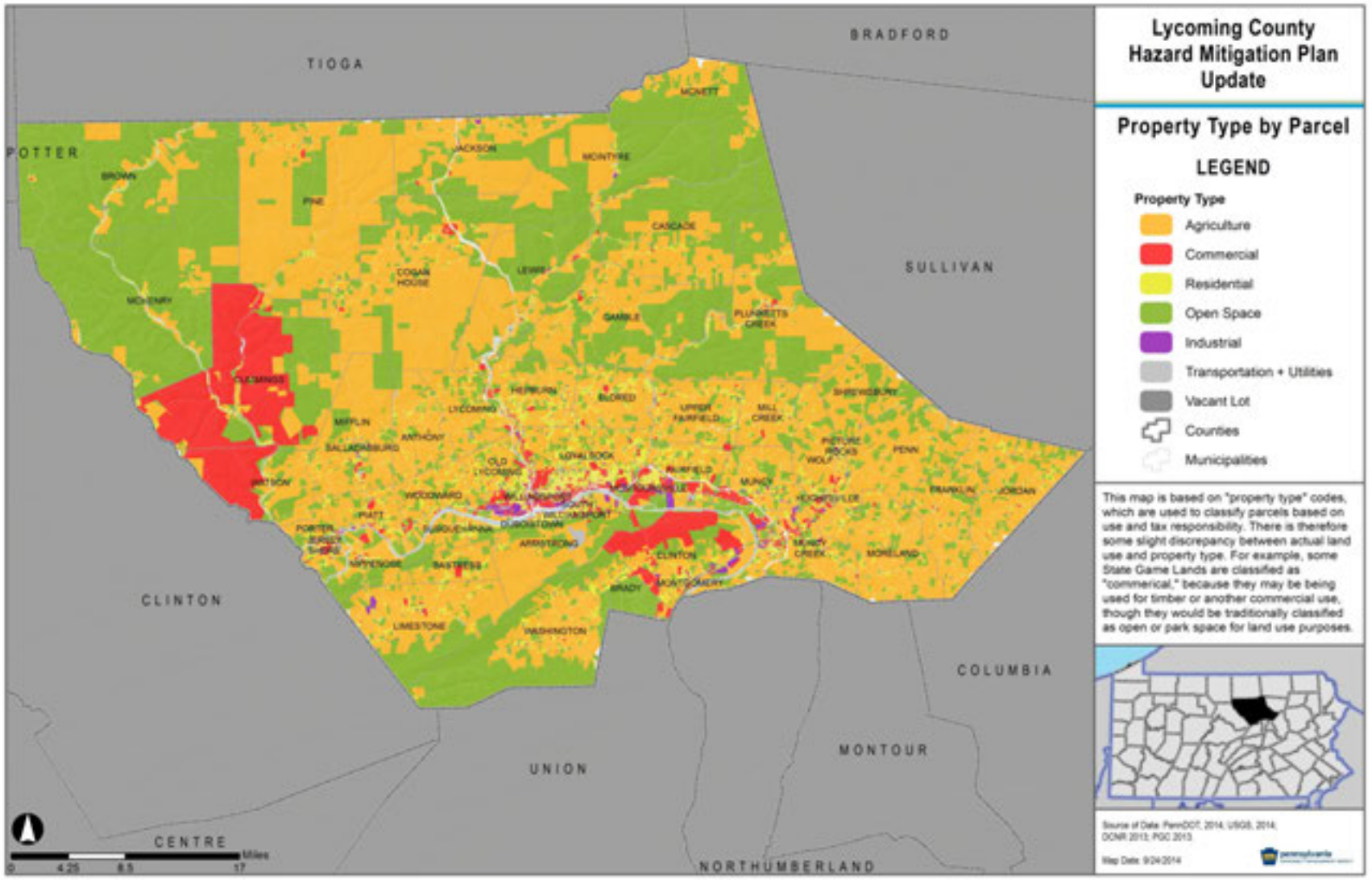


Figure 2.4-3 Lycoming County property types by parcel.



2.5. Data Sources and Limitations

The Lycoming County Department of Public Safety's Buildings (point data) and parcel (polygon layer) databases were used as an inventory of properties throughout the County. The buildings data did not include type or value. However, the Lycoming County GIS Department recommended using a spatial join between the buildings and the parcel database to associate a building use with each building using the property type codes assigned to each parcel. These property types were assigned a generalized land use code of agricultural, commercial, industrial, residential, transportation/utilities, and unknown (for parcels with no property type code). While this allows for generalized discussion of the type of buildings at risk in Lycoming County, the number of buildings by type used throughout this HMP should be considered estimates. The actual building and land use may differ than information contained in the database. The property type was used to extract numbers of mobile homes. The buildings layer also did not have a value associated with each structure. As a result, loss estimates were derived from the parcel database.

Flood hazard data used in this plan is Lycoming County's effective DFIRM database from the National Flood Hazard Layer, which includes the countywide DFIRM database dated March 2004 as well as the eight panels revised in February 2014. This data is a digital representation of features of Flood Insurance Rate Maps (FIRMs). Lycoming County provided other GIS datasets including transportation infrastructure, boundaries, community facilities, buyout properties, and karst features. Additional data for the base map was provided by the Pennsylvania Department of Transportation, Pennsylvania Game Commission, and the Pennsylvania Department of Conservation and Natural Resources.

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, data on past occurrences of damaging hazard events was gathered. For a number of historic natural-hazard events, the National Climatic Data Center (NCDC) database was utilized. NCDC is a division of the US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by NCDC from data gathered by the National Weather Service (NWS), another division of NOAA. NCDC then presents it on their website in various formats. The data used for this plan came from the US Storm Events database, which "documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to

commerce" (NOAA, 2006). Due to changes in the data collection procedures over time, there may be more events available for certain kinds of natural hazards; incidences listed in this plan reflect data housed in the NCDC Storm Events Database as of September 2014.

HAZUS-MH is a powerful risk assessment methodology for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH, current scientific and engineering knowledge is coupled with the latest GIS technology to produce estimates of hazard-related damage before, or after, a disaster occurs. HAZUS version 2.1 was used to estimate losses for floods in Lycoming County; this plan incorporates an enhanced analysis, meaning that county-specific data was incorporated into the model to make it more precise. In addition, Lycoming County's 1% annual-chance depth grid, a Risk MAP non-regulatory product, was used to incorporate the most recent hydraulic and hydrologic modeling in the county. For more information on the enhanced analysis methodology used for this plan's flood model, please see Appendix F.

This HMP evaluates the vulnerability of the County's critical facilities. The list of critical facilities provided in Appendix E was developed based on information provided by the Lycoming County GIS Department. For the purposes of this plan, critical facilities are those entities that are essential to the health and welfare of the community. This includes law enforcement, emergency response, electric power, medical services, child and eldercare facilities, churches, and SARA Title III facilities. Table 2.5-1 summarizes the critical facilities in Lycoming County by type and by municipality. For a complete listing of critical facilities and their vulnerability to individual hazards, please see Appendix E.

Table 2.5-1 Critical facilities by type and municipality (Lycoming County GIS, 2014).

MUNICIPALITY	CHURCH	ELECTRIC SUBSTATION	EM. OPERATION CENTER	FIRE DEPT	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	POLICE STATION	PRE-SCHOOL/ CHILD CARE	PRISON	SARA FACILITY	SCHOOLS	GRAND TOTAL
Anthony Township	2	0	2	0	0	1	0	0	0	0	1	0	6
Armstrong Township	0	0	0	0	0	1	0	0	0	0	1	0	2
Bastress Township	0	0	2	0	0	1	0	0	0	0	0	1	4
Brady Township	0	0	2	0	0	1	0	0	0	0	0	0	3
Brown Township	0	0	1	2	0	1	0	0	0	0	0	0	4
Cascade Township	2	0	1	0	0	1	0	0	0	0	0	0	4
Clinton Township	2	2	2	1	0	1	0	1	0	1	7	4	21
Cogan House Township	7	0	3	0	0	1	0	0	0	0	0	0	11
Cummings Township	0	0	2	1	0	1	0	0	0	0	0	0	4
Duboistown Borough	3	0	1	1	0	1	0	1	1	0	0	0	8
Eldred Township	1	0	1	1	0	1	0	0	1	0	0	0	5
Fairfield Township	5	1	1	0	0	1	0	0	1	0	2	1	12
Franklin Township	5	0	1	1	0	1	0	0	1	0	0	1	10
Gamble Township	1	0	2	0	0	1	0	0	0	0	0	0	4
Hepburn Township	6	0	2	1	0	1	0	0	1	0	0	1	12
Hughesville Borough	10	0	2	1	0	1	0	1	5	0	0	1	21
Jackson Township	0	0	0	0	0	1	0	0	0	0	1	0	2
Jersey Shore Borough	17	1	4	2	1	1	1	1	6	0	2	3	39
Jordan Township	4	0	2	1	0	1	0	0	0	0	0	0	8

Table 2.5-1 Critical facilities by type and municipality (Lycoming County GIS, 2014).

MUNICIPALITY	CHURCH	ELECTRIC SUBSTATION	EM. OPERATION CENTER	FIRE DEPT	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	POLICE STATION	PRE-SCHOOL/ CHILD CARE	PRISON	SARA FACILITY	SCHOOLS	GRAND TOTAL
Lewis Township	3	0	2	1	0	1	0	0	0	0	0	0	7
Limestone Township	5	0	2	1	0	1	0	0	2	0	0	3	14
Loyalsock Township	21	3	2	1	0	1	7	0	9	1	2	7	54
Lycoming Township	3	0	0	0	0	1	0	0	0	0	2	0	6
McHenry Township	0	1	2	1	0	1	0	0	0	0	0	0	5
McIntyre Township	4	0	2	1	0	1	0	0	0	0	0	0	8
McNett Township	0	0	1	0	0	1	0	0	0	0	0	0	2
Mifflin Township	0	0	2	0	0	1	0	0	1	0	1	1	6
Mill Creek Township	1	0	2	0	0	1	0	0	0	0	0	0	4
Montgomery Borough	7	0	2	1	0	1	0	1	0	0	2	0	14
Montoursville Borough	11	1	2	2	0	1	0	2	5	0	4	4	32
Moreland Township	3	0	3	0	0	1	0	0	0	0	0	0	7
Muncy Borough	6	0	2	1	0	1	0	1	2	0	2	2	17
Muncy Creek Township	9	1	2	1	1	1	1	0	0	0	5	0	21
Muncy Township	4	0	2	1	0	1	0	1	0	0	5	0	14
Nippenose Township	1	0	2	1	0	1	0	0	1	0	1	0	7
Old Lycoming Township	9	0	2	1	0	1	0	1	4	0	3	1	22

Table 2.5-1 Critical facilities by type and municipality (Lycoming County GIS, 2014).

MUNICIPALITY	CHURCH	ELECTRIC SUBSTATION	EM. OPERATION CENTER	FIRE DEPT	HOSPITAL	MUNICIPAL BUILDING	NURSING HOME	POLICE STATION	PRE-SCHOOL/ CHILD CARE	PRISON	SARA FACILITY	SCHOOLS	GRAND TOTAL
Penn Township	0	0	1	0	0	1	0	0	0	0	0	0	2
Piatt Township	3	1	0	0	0	1	0	0	0	0	0	0	5
Picture Rocks Borough	4	0	2	1	0	1	0	0	0	0	0	1	9
Pine Township	1	0	1	0	0	1	0	0	0	0	0	0	3
Plunketts Creek Township	2	1	2	1	0	1	0	0	0	0	0	0	7
Porter Township	1	0	3	0	0	1	0	1	0	0	0	1	7
Salladasburg Borough	0	0	1	1	0	0	0	0	0	0	0	0	2
Shrewsbury Township	1	0	0	0	0	1	0	0	0	0	0	0	2
South Williamsport Borough	9	2	2	3	0	1	0	1	5	0	1	4	28
Susquehanna Township	1	0	1	1	0	1	0	0	0	0	1	1	6
Upper Fairfield Township	7	1	3	0	0	1	0	0	1	0	0	1	14
Washington Township	3	2	2	1	0	1	0	0	0	0	1	1	11
Watson Township	0	0	1	0	0	0	0	0	0	0	0	0	1
Williamsport, City of	47	3	4	2	2	1	1	2	32	1	19	15	129
Wolf Township	2	1	2	0	0	1	0	0	6	0	2	1	15
Woodward Township	8	0	2	1	0	1	0	0	1	0	0	1	14
Grand Total	**241**	**21**	**90**	**36**	**4**	**50**	**10**	**14**	**85**	**3**	**65**	**56**	**675**

3. Planning Process

3.1. Update Process and Participation Summary

A successful planning process builds partnerships and brings together members representing government agencies, the public, and other stakeholders to reach consensus on how the community will prepare for and respond to hazards that are most likely to occur. Applying a comprehensive and transparent process adds validity to the Plan. Those involved gain a better understanding of the problem or issue and how solutions and actions were devised. The result is an updated set of common community values and widespread support for directing financial, technical, and human resources to an agreed-upon action. The planning process has been an integral part of updating the Lycoming County Multi-Jurisdictional Hazard Mitigation Plan (HMP), which was originally adopted on September 24, 2004. This section describes Lycoming County's update process and how the HMP evolved since it was first approved by the Federal Emergency Management Agency (FEMA).

The 2015 HMP Update was again led by the Lycoming County Department of Planning and Development. To facilitate the update of the 2014 HMP, PEMA contracted with Baker, to assist in updating Lycoming County's HMP. In accordance with the Disaster Mitigation Act of 2000 (DMA 2000) requirements, this plan documents the following topics:

1. Planning process
2. Hazard identification
3. Risk assessment
4. Mitigation strategy: goals, actions, and projects
5. Formal adoption by the participating jurisdictions
6. PEMA and FEMA approval

During the 2004 update process, planners began by identifying the hazards that could significantly impact the County and its municipalities, and they determined these hazards' economic, social, and environmental impacts. From this analysis, the County created an action strategy identifying technically feasible and cost-effective mitigation actions to reduce hazard impacts. In 2010, the HMP underwent a restructure so that it met the requirements set forth by PEMA using the Pennsylvania Hazard Mitigation Standard Operating Guidance. During the 2015 update, stakeholder feedback was solicited through meetings, workshops, a project website, and written and electronic communication. A total of thirteen hazards were identified and profiled in 2010. Dam Failure, Disorientation, Levee Failure, and Radon Exposure were added to the HMP during the 2015 update, in order to address the County's forested areas and the potential for individuals to become lost and disoriented. Stakeholders were asked to provide information on identified hazards and to assist with the Risk Factor ranking.

The mitigation strategy was reviewed by the Steering Committee and stakeholders provided information about what had been accomplished over the last five years along with actions and projects to be implemented moving forward.

The report format is structured in accordance with the most current planning guidance from FEMA, Local Mitigation Handbook (2013), and PEMA, Standard Operating Guide (SOG) (October 2013).

While the overall format between the 2015 HMP Update and the 2010 HMP Update has not changed, there are a few content changes.

Hazard Definitions. A standard list of hazard definitions, Risk Assessment Hazard Descriptions, has been developed. Therefore, hazards identified in the 2010 HMP Update are referred to in the 2015 HMP Update using slightly different terminology. For example, 'Flooding' in the 2010 HMP Update is referred to as 'Flood, Flash Flood, Ice Jam' in the 2015 HMP Update. 'Hazardous Materials' in the 2010 HMP Update is referred to as 'Environmental Hazards' in the 2015 HMP Update.

Mitigation Techniques. FEMA's 2013 Local Mitigation Handbook has reduced the number of mitigation techniques from six to four as shown in the following table. The major difference is that emergency services is no longer a mitigation technique category, as emergency services activities are more appropriately located in an emergency response plan.

Planning Data Collection Tools. Standard data collection and documentation tools were developed as part of the SOG and have been used in the 2015 HMP Update including: a revised Capability Assessment Survey, a National Flood Insurance Program (NFIP) worksheet, a Hazard Identification and Risk Evaluation Worksheet, and tools to evaluate and prioritize mitigation actions.

Specific process updates pertaining to each section of the HMP Update are included in Sections 4.1, 5.1, 6.1 and 7.1.

3.2. The Planning Team

The County's Steering Committee consists of:

- Salvatore Vitko, Hazard Reduction Planner, Lycoming County Planning and Community Development
- Frances McJunkin, Deputy Director, Lycoming County Planning and Community Development
- John Lavelle, Development Services Supervisor, Lycoming County Planning and Community Development
- Scott Williams, GIS/Data Systems Analyst, Lycoming County Planning and Community Development

The Steering Committee was supported by municipal officials and other agency/organization representatives. During the 2010 HMP update, stakeholders were divided into six WOGs as defined in Section 2.1 and illustrated in Figure 2.1-2:

- Larrys Creek
- Loyalsock Creek
- Lycoming Creek
- Muncy Creek
- Pine Creek
- West Branch Susquehanna River

These WOG's have been carried through the RiskMAP process which is currently taking place in Lycoming County and certain flood vulnerability information has been provided on a watershed level in order to link these two planning mechanisms (see Section 4.3.3). Municipal participation is summarized below in Section 3.5.

The stakeholders listed in Table 3.2-1 served on the 2014 planning team, demonstrating their commitment to actively participate in the planning process by attending meetings, completing assessments, surveys, and worksheets, and/or submitting comments. The planning team consisted of county and local officials including municipal supervisors and council members, emergency management coordinators, and the other identified stakeholders

Table 3.2-1 Participants in the 2015 Lycoming County HMP Update.

MUNICIPALITY/ORGANIZATION	PARTICIPANT(S)
Armstrong Township	Jim Dunn, Supervisor
Anadarko Petroleum Corporation	Mathew J. Lock, HSE Representative
Bastress Township	John Deitrick, Supervisor Patricia Dincher, Secretary
Brown Township	Eleanor Pauke, Secretary/Treasurer Dennis Paucke, Supervisor
Cascade Township	Joe Colucci, EMC
Clinton County EMA	William Frantz, EMC
Clinton Township	Ed Shrimp, Supervisor Lanny Wertz, Roadmaster Janet Mincemoyer, Treasurer
Cogan House Township	Iva Mae Guillaume, EMC Robert Emery, Supervisor Howard Fry, Supervisor
Columbia County EMA	Tarah Kishbach, Operations and Training Officer
Cummings Township	John Gasperine, Supervisor Tom Thompson, Supervisor
Department of Environmental Protection	Jim Miller, Assistant Regional Director
Eldred Township	Ken Bower, Supervisor Mark Rank, Supervisor
Fairfield Township	Ronald Springman, Secretary Carol Camp, Auditor

Table 3.2-1 Participants in the 2015 Lycoming County HMP Update.	
MUNICIPALITY/ORGANIZATION	**PARTICIPANT(S)**
Franklin Township	Raine Ohnmeiss, Sec/Treasurer Dorrance Berger, Supervisor
Gamble Township	Joe Colucci, EMC Pat Hipple, Secretary
Hepburn Township	Galen Davenport, Secretary
Jersey Shore Borough	Dennis Buttorff, Mayor
Jordan Township	Raine Ohnmeiss, Sec/Treasurer Loretta Fulton
Lewis Township	David Swift, Supervisor Charlest Whitford, EMC Mary Lou Coleman, Secretary
Limestone Township	Rich Collins, Supervisor Jeanne Engel, Secretary
Loyalsock Township	Richard Wheeland, Supervisor Paul Nyman, Supervisor Marc Sortman, Supervisor
Lycoming Township	Larry DeRemer, Supervisor
Lycoming Creek Watershed Association	Mike Ditchfield, Board Member
Lycoming County	Salvatore Vitko, Hazard Reduction Planner Frances McJunkin, Deputy Director John Lavelle, Development Services Supervisor Scott Williams, GIS/Data Systems Analyst Jeff Wheeland, County Commissioner Bill Kelly, Deputy Director
Lycoming County Conservation District	Carey Entz-Rine, Watershed Specialist
McHenry Township	Steve Dawson, Supervisor Paul Hoffmaster, Supervisor Donald Price, Supervisor
McIntyre Township	Dan Clark, Supervisor Al Boyer, Supervisor
McNett Township	Raymond Miller, EMC
Mill Creek Township	Anne Hall, Auditor Norma Zeisloft, Tax Collector
Moreland Township	Susan Liuzza, Secretary/Treasurer
Muncy Creek Township	Cindy Newcomer, Sec/Treasurer David A Rupert, Supervisor
Muncy Township	Paul Wentzler, Supervisor Linda Hartley, Auditor
Old Lycoming Township	Robert Whitford, Township Manager Janet Hall, Supervisor Linda Mazzullo, Supervisor
Penn Township	Bryan Boyer, EMC Charles Zook, Supervisor
PennDOT	Ray Kennedy, Environmental Manager Ken Bair, Main Services Engineer Jeff Beattie, Assistant Highway Manager
Piatt Township	Dennis Buttorff, EMC Dennis M. Rager, Supervisor
Picture Rocks Borough	William N. Dorum, Sec/Treasurer Eugene R. Otterbein, Council President
Pine Township	Iva Mae Guillaume, EMC
Plunketts Creek Township	Thomas Shafer, EMC Bradley Stine, EMA
Porter Township	Paul West, Supervisor

Table 3.2-1 Participants in the 2015 Lycoming County HMP Update.	
MUNICIPALITY/ORGANIZATION	**PARTICIPANT(S)**
Shrewsbury Township	Randy White, Supervisor Terry Durchi, Supervisor Mary Gray, Auditor
Shrewsbury Township	Terry Durchi, Supervisor
Susquehanna Township	Jim Surfield, Supervisor
Upper Fairfield Township	Luther E. Lunt, Supervisor
Washington Township	Kenneth Bashista, Supervisor Dean Showers, Auditor
City of Williamsport	John Grado
Wolf Township	William A. DeWire, Supervisor
Woodward Township	Judy Carpenter, Secretary Hugh E. McGee, Auditor

3.3. Meetings and Documentation

The following meetings, both in person and teleconference, were held as part of the planning process. Meeting documentation in the form of invitations (letter and e-mail format), agendas, sign-in sheets, handouts, presentations, flyers, and minutes are included in Appendix C - Meeting and Other Participation Documentation.

Steering Committee Kick-off Meeting, July 17, 2014: This meeting was held with the Steering Committee to coordinate the update process. Discussion topics including meeting schedules, stakeholder list, data needs, and mitigation strategy were covered during the teleconference.

Hazard Mitigation Planning Workshop, Thursday, August 14, 2014: The purpose of the meeting was to reconvene the Planning Team and to review and evaluate the existing hazard mitigation plan.

As part of the workshop, municipalities and stakeholders were asked to complete a hazard risk evaluation form (Hazards in Your Community). The form included the 13 hazards to be profiled for the 2015 HMP Update and requested attendees to rank hazards relative spatial extent, probable impact, probability of future events, and overall significance. Results of the hazard risk evaluation form were used to prepare the 2014 Risk Factor ranking.

The HMP Workshop provided the opportunity for municipalities to submit and ask questions about Capability Assessment Surveys. Capability Assessment Surveys from 2009 were printed and distributed at the HMP Workshop. Municipalities were asked to make changes and updates to the Capability Assessment as needed. The NFIP worksheet was pre-populated for each community with community specific information from FEMA's Community Information System (CIS) database. Fields that were not pre-populated were to be completed by each municipality.

Workshop attendees reviewed the mitigation strategy from the 2010 HMP using the Mitigation Strategy Evaluation Form. Municipalities and other stakeholders provided input on municipal-specific mitigation actions by identifying progress on actions and by identifying new actions to implement over the next five years.

Forms completed during the HMP Workshop were mailed to all municipalities that were unable to attend the HMP Workshop. All forms were also made available for download on the project website.

Public Meeting, September 25, 2014: This public meeting was held to review the Draft HMP and to obtain feedback from stakeholders. Additional mitigation actions were developed and collected as well. Attendees were provided with comment forms to submit questions or comments about the material that had been covered during the meeting.

Lycoming County Association of Township Officials Meeting, October 22, 2014: During this regularly scheduled meeting, the Planning Director provided a brief summary about the current hazard mitigation plan update and the County's Hazard Reduction Planner manned a table to provide municipal officials with additional information about the planning process and to hand out planning forms and questionnaires.

3.4. Public & Stakeholder Participation

Figure 3.4-1 Lycoming County HMP Newspaper Notice.

PUBLIC NOTICE

Hazard Mitigation Plan Review for Lycoming County, Pennsylvania

Notice is hereby given that the Lycoming County Department of Planning and Community Development will hold a public meeting to review the Draft Lycoming County Hazard Mitigation Plan on Thursday, September 25, 2014 from 6:00 PM – 8:00 PM. This meeting is to be held at the Executive Plaza Building, 1st Floor, Lycoming County Commissioner's Board Room, 330 Pine Street, Williamsport, PA 17701. The Plan describes the hazards that can affect Lycoming County and its municipalities and the actions that can be taken to reduce their impact on the community. Questions may be directed to Mr. Salvatore Vitko, Lycoming County Hazard Reduction Planner, at 570-320-2133 or svitko@lyco.org. Interested persons may download and review an electronic copy of the Draft Plan at http://www.pennsylvaniahmp.com/lycoming-hmp starting on September 30, 2014.

Local, state, and federal agencies, neighboring jurisdictions, local businesses, community leaders, educators, and other relevant private and nonprofit groups (e.g., watershed associations) that had a vested interest in the development of the updated Plan were given the opportunity (through direct invitation – see the meeting materials in Appendix C) to participate in the planning process by attending a planning or public meeting, or offering comment on the Web site posting the existing HMP. Twenty municipalities' representatives attended at least one of these meetings. Through attendance at a Steering Committee and/or public meetings, municipal representatives, state agencies, and other organizations were provided the opportunity to guide the HMP's development. Representatives of these organizations participated in discussions and provided input on the HMP during the meetings they attended.

Through a public notice published in the Sun Gazette, the above groups and the general public were notified of the public meeting and invited to review the Plan on the project web site (http://www.pennsylvaniahmp.com/lycoming-hmp). The September 20, 2014 public notice for the public meeting is shown in Figure 3.4-1.

The project website, which was updated throughout the planning process, included a project calendar, announcements page and a library, where important planning documents and forms were made available for upload. Figure 3.4-2 displays the home page of the project website. A copy of the Draft HMP was also available for download and comment at the website. Interested parties were able to comment on the plan through the project website or a comment form could be downloaded, filled in, and faxed, mailed, or emailed.

Figure 3.4-2 Lycoming County HMP Project Website, www.pennsylvaniahmp.com/lycoming-hmp.

The draft HMP was posted to the project website on September 30, 2014 and the comment period has remained open. Comments were not received through the project website and no comment forms were submitted during the final public meeting.

3.5. Multi-Jurisdictional Planning

Forty of Lycoming County's 52 municipalities participated in the planning process. A detailed account of municipal participation can be found in Table 3.5-1.

Each municipality was part of the Planning Team developed for the 2015 HMP Update and invited to participate in meetings held in the Lycoming County Commissioners Board Room.

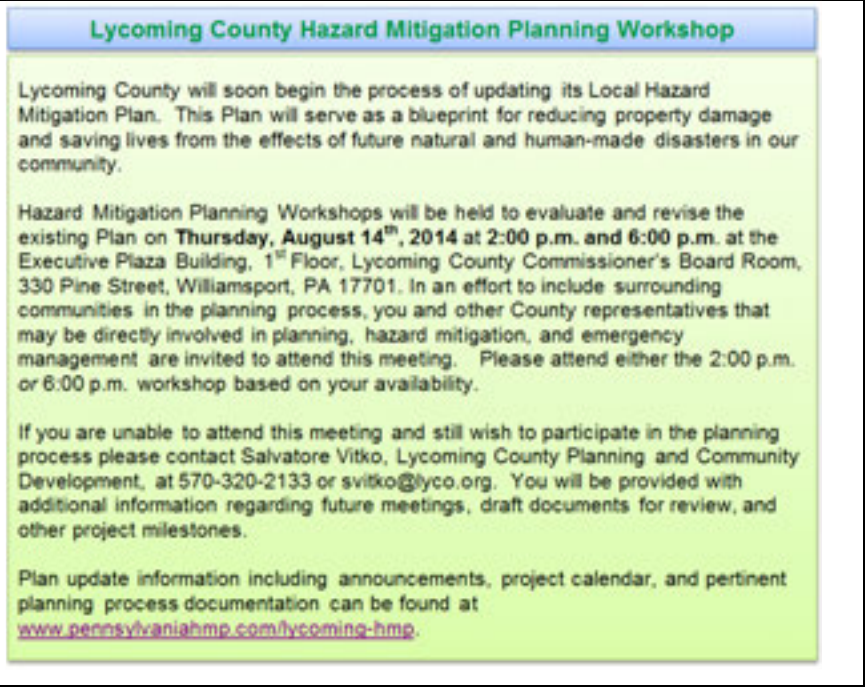
The HMP Workshop was held on August 14, 2014 with a total of 17 municipalities represented at the meeting. Meeting invitations were mailed to municipal CEO's on July 24, 2014 and other identified stakeholders received either a paper invitation or an email announcement as shown below in Figure 3.5-1.

On August 28, 2014, the Lycoming County Department of Planning and Development mailed a packet containing workshop materials to EMC's of municipalities that were unable to attend the August 14th HMP Workshop and/or had not submitted any planning documentation approximately two weeks after the HMP Workshop.

In addition to discussing the Capability Assessment Survey and NFIP worksheet, the HMP Workshop provided the opportunity for municipalities to comment on hazards identified by the Steering Committee. This was accomplished through a risk assessment exercise where

municipalities were asked to complete a hazard risk evaluation form (Hazards in Your Community). The form listed hazards to be profiled for the 2015 HMP Update and prompted municipalities to rank hazards relative to spatial extent, probable impact, probability of future events, and overall significance. Results of the hazard risk evaluation form were used to prepare the 2014 Risk Factor ranking. The form also afforded municipalities the opportunity to provide input on specific instances of a listed hazard in their community and on additional hazards that may impact their community.

Figure 3.5-1 Lycoming County Stakeholder HMP Workshop Email Invitation.



Lycoming County Hazard Mitigation Planning Workshop

Lycoming County will soon begin the process of updating its Local Hazard Mitigation Plan. This Plan will serve as a blueprint for reducing property damage and saving lives from the effects of future natural and human-made disasters in our community.

Hazard Mitigation Planning Workshops will be held to evaluate and revise the existing Plan on **Thursday, August 14th, 2014 at 2:00 p.m. and 6:00 p.m.** at the Executive Plaza Building, 1st Floor, Lycoming County Commissioner's Board Room, 330 Pine Street, Williamsport, PA 17701. In an effort to include surrounding communities in the planning process, you and other County representatives that may be directly involved in planning, hazard mitigation, and emergency management are invited to attend this meeting. Please attend either the 2:00 p.m. *or* 6:00 p.m. workshop based on your availability.

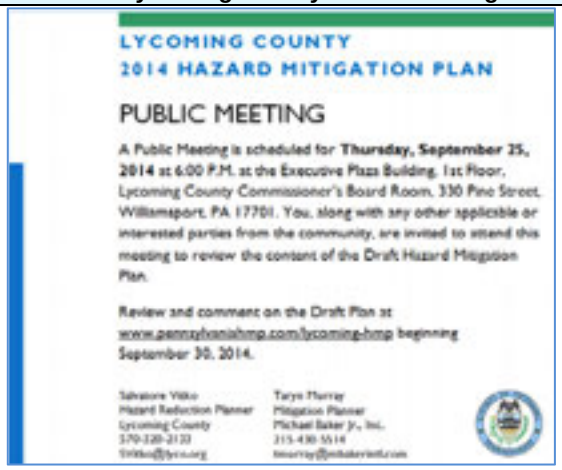
If you are unable to attend this meeting and still wish to participate in the planning process please contact Salvatore Vitko, Lycoming County Planning and Community Development, at 570-320-2133 or svitko@lyco.org. You will be provided with additional information regarding future meetings, draft documents for review, and other project milestones.

Plan update information including announcements, project calendar, and pertinent planning process documentation can be found at www.pennsylvaniahmp.com/lycoming-hmp.

The HMP Workshop provided the opportunity to review and comment on the 2010 Mitigation Strategy. Through use of the Mitigation Strategy Evaluation Form, municipalities provided input on mitigation actions by identifying if an action was completed, canceled, deferred, or is ongoing; what was accomplished for the action during the reporting period; obstacles encountered; and if the action is still relevant or if it should be revised. Municipalities were asked to identify progress on any other actions not identified in the 2010 plan, identify new actions to accomplish over the next 5 years, and complete a mitigation action form for new mitigation actions.

A post-card invitation, as shown in Figure 3.5-2, was mailed at the beginning of September to each municipality, announcing the public meeting held on September 25, 2014. In addition to providing upcoming meeting information, the project website and Draft HMP review information was listed.

Figure 3.5-2 Lycoming County Public Meeting Post Card.



A separate e-mail was sent to other stakeholders announcing the Public Meeting and Draft HMP review period and an announcement was posted to the project website with similar information. As described in Section 3.4, a public notice was published in the local newspaper to disseminate information about the Public Meeting and the availability of the Draft HMP for review.

On October 17, 2014, the County Hazard Reduction Planner sent an email to all local EMCs with information on how to participate in the hazard mitigation planning process. The Risk Assessment Exercise was provided as an attachment and an announcement that HMP information would be available at the October 22, 2014 Lycoming County Association of Township Officials meeting.

Thirty-four municipalities attended the Township Officials Meeting and were provided an overview of the HMP update and given the opportunity to obtain planning documentation and submit local information. Meeting minutes and the sign-in sheet are located in Appendix C. As of late October, no comments had yet been received on the Draft HMP, therefore an additional email blast was sent to over 100 stakeholders including all primary municipal addresses, local EMCs, and all other stakeholders that had previously attended in person meetings. The email contained links to the Draft HMP, the comment form, the project website and instructions on how to submit comments.

Table 3.5-1 Lycoming County 2015 HMP Update Community Participation

MUNICIPALITY	MEETINGS			SURVEYS/FORMS		
	HMP Workshop August 14, 2014	Public Meeting September 25, 2014	Township Officials Meeting October 22, 2014	Capability Assessment Survey / NFIP Worksheet	Risk Assessment Worksheet	Mitigation Strategy Evaluation
Anthony Township						
Armstrong Township			X	X		X
Bastress Township			X			
Brady Township			X			
Brown Township			X			
Cascade Township		X	X			
Clinton Township			X			
Cogan House Township	X		X	X	X	Y
Cummings Township	X		X	X	X	
Duboistown Borough						
Eldred Township			X			
Fairfield Township			X			
Franklin Township	X		X	X	X	X
Gamble Township		X	X	X	X	X
Hepburn Township			X			
Hughesville Borough						
Jackson Township						
Jersey Shore Borough	X			X	X	X
Jordan Township	X		X	X	X	
Lewis Township	X		X	X	X	Y
Limestone Township			X			
Loyalsock Township			X			
Lycoming Township			X			
McHenry Township	X		X	X	X	Y
McIntyre Township		X	X			
McNett Township				X	X	X
Mifflin Township						

Table 3.5-1 Lycoming County 2015 HMP Update Community Participation						
MUNICIPALITY	MEETINGS			SURVEYS/FORMS		
	HMP Workshop August 14, 2014	Public Meeting September 25, 2014	Township Officials Meeting October 22, 2014	Capability Assessment Survey / NFIP Worksheet	Risk Assessment Worksheet	Mitigation Strategy Evaluation
Mill Creek Township			X			
Montgomery Borough						
Montoursville Borough						
Moreland Township			X			
Muncy Borough						
Muncy Creek Township	X		X	X	X	X
Muncy Township	X		X	X	X	X
Nippenose Township			X			
Old Lycoming Township			X			
Penn Township			X		X	
Piatt Township	X		X	X	X	
Picture Rocks Borough	X	X		X	X	
Pine Township	X			X	X	X
Plunketts Creek Township	X			X	X	
Porter Township	X		X	X	X	
Salladasburg Borough						
Shrewsbury Township	X		X			
South Williamsport Borough						
Susquehanna Township	X		X			
Upper Fairfield Township		X	X			
Washington Township			X			
Watson Township						
City of Williamsport			X*			X
Wolf Township	X		X	X	X	X
Woodward Township			X			

*One-on-one phone call with County Hazard Planner, Sal

4. Risk Assessment

4.1. Update Process Summary

The risk assessment provides a factual basis for activities proposed by the County in their mitigation strategy. Hazards that may affect Lycoming County are identified and defined in terms of their location and extent, magnitude of impacts, previous events, and probability of future events. The Risk Assessment section of the Lycoming County HMP update utilizes existing data and analysis from the previous Federal Emergency Management Agency (FEMA)-approved HMP as well as more recent data and analysis on hazards occurring during the last five years.

As Lycoming County's development, people, and economy change, so too do its hazards and vulnerabilities. In 2005, Lycoming County profiled flooding, winter storms, tropical storms and hurricanes, tornadoes and wind storms, hazardous material incidents, fixed nuclear incidents, droughts and water supply deficiencies, fires, and terrorism.

In the 2010 HMP update, the names of hazards and the organization of the hazard profiles were changed to match the first Pennsylvania Standard Operating Guidance. The list of hazards profiled included:

- Drought,
- Earthquake,
- Flood, Flash Flood, Ice Jam,
- Hailstorm,
- Subsidence, Sinkhole,
- Tornado, Windstorm,
- Wildfire,
- Winter Storm,
- Environmental Hazards: Natural Gas Drilling Incidents,
- Nuclear Incidents, and
- Utility interruption.

For the 2015 HMP Update, hazard names were again refined to best match the updated 2013 Pennsylvania Standard Operating Guidance. In addition, the Lycoming County Steering Committee evaluated the development, population, and growth trends in the County vis-à-vis the Pennsylvania Standard List of Hazards and the 2013 Pennsylvania Standard State All-Hazard Mitigation Plan. The Steering Committee and stakeholders assessed the change in risk for all hazards identified in the 2010 plan and voted on which hazards not previously identified but included in the Pennsylvania Standard State List of Hazards had the potential to impact Lycoming County using the Evaluation of Identified Hazard and Risk Form (found in Appendix C). After this hazard identification and evaluation, the HMPSC agreed to add one new hazard to the 2014 HMP: Disorientation. The decision to add a full hazard profile and mitigation actions for disorientation stemmed from the large amount of publicly-held recreation lands and the general lack of cell phone coverage in Lycoming County.

Hazard profiles were then developed in order to define the characteristics of each hazard as they apply to Lycoming County and North-Central Pennsylvania. Each municipality and the other stakeholders participating in the planning process then evaluated the impact of hazard profiled in their jurisdiction or organization using the Hazards in Your Community Worksheet (see Appendix C). This evaluation, together with the research and analysis of each hazard, allowed for an assessment of jurisdictional risk, discussed in Section 4.4.2.

Following hazard identification and profiling, a vulnerability assessment was conducted for each hazard to identify the impact of both natural and human-made hazard events on people, buildings, infrastructure, and the community, as appropriate. Each hazard is discussed in terms of its potential impact on individual communities, including the types of structures that may be at risk. This assessment allows the County and its municipalities to focus on and prioritize local mitigation efforts on areas that are most likely to be damaged or require early response to a hazard event. A vulnerability analysis was performed which identifies structures, critical facilities, and/or populations that may be impacted during hazard events and describes what events can do to physical, social, and economic assets.

4.2. Hazard Identification

Pennsylvania's disaster history helps provide direction on the identification of hazards and their significance both at the state and local level. PEMA maintains a historical log of all disasters that have occurred in the Commonwealth dating back to 1955. An analysis of the past occurrences of each hazard is the first step toward predicting the future susceptibility to that hazard. By noting the hazards of the past, Lycoming County and its municipalities will be able to better understand and prepare for future natural and human-made disasters.

4.2.1. Table of Presidential Disaster Declarations

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

There is no financial threshold for an Emergency Declaration, but there are two thresholds for Presidential Disaster Declarations established under the Stafford Act: a state and a county threshold. These thresholds are based on a formula that uses the population of the jurisdiction (as recorded in the decennial Census) times a set per capita indicator. As of federal fiscal year 2013-14, these thresholds are $3.50 per capita for counties and $1.37 per capita for the state. With a population of over 116,000, the Lycoming County threshold is approximately $408,600. State and county thresholds must be simultaneously attained for a Presidential Disaster Declaration to be issued.

Table 4.2-1 displays the Presidential Disaster and Emergency Declarations that have affected Lycoming County from 1955-2014 from most recent to oldest event.

Table 4.2-1 Presidential Disaster and Emergency Declarations affecting Lycoming County.			
DATE	**DECLARATION AND EVENT TYPE**	**DECLARATION NUMBER**	**AFFECTED AREAS**
October 2012	Emergency Declaration – Hurricane Sandy	3356	All counties
September 2011	Emergency Declaration – Remnants of Tropical Storm Lee	3340	Adams, Bedford, Berks, Blair, Bradford, Bucks, Cambria, Carbon, Centre, Chester, Clinton, Clinton, Columbia, Cumberland, Dauphin, Delaware, Franklin, Fulton, Huntingdon, Juniata, Lackawanna, Lancaster, Lebanon, Lehigh, Luzerne, Lycoming, Mifflin, Monroe, Montgomery, Montour, Northumberland, Northampton, Perry, Philadelphia, Schuylkill, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Wyoming, York
September 2011	Presidential Disaster Declaration - Remnants of Tropical Storm Lee	4030	Adams, Bedford, Berks, Bradford, Bucks, Chester, Columbia, Dauphin, Huntingdon, Juniata, Lackawanna, Lancaster, Lebanon, Luzerne, Lycoming, Mifflin, Montgomery, Montour, Northampton, Northumberland, Perry, Schuylkill, Snyder, Sullivan, Susquehanna, Tioga, Union, Wayne, Wyoming, and York
July 2011	Presidential Disaster Declaration – Severe Storms and Flooding	4003	Bradford, Lycoming, Sullivan, Tioga, and Wyoming
September 2005 (Emergency Declaration)	Emergency Declaration – Hurricane Katrina	3235	All counties: Proclamation of Emergency to Render Mutual Aid and to Receive and House Evacuees
September 2004	Tropical Depression Ivan	1557	Allegheny, Armstrong, Beaver, Bedford, Blair, Bradford, Bucks, Butler, Cameron, Carbon, Centre, Clarion, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Elk, Franklin, Fulton, Green, Huntingdon, Indiana, Jefferson, Juniata, Lackawanna, Lawrence, Lebanon, Lehigh, Luzerne, Lycoming, Mifflin, Monroe, Montour, Northampton, Northumberland, Perry, Pike, Potter, Schuylkill, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Washington, Wayne, Westmoreland, Wyoming, and York

Table 4.2-1 Presidential Disaster and Emergency Declarations affecting Lycoming County.			
DATE	**DECLARATION AND EVENT TYPE**	**DECLARATION NUMBER**	**AFFECTED AREAS**
February 2003	Emergency Declaration – Severe Winter Storm	3180	Adams, Bedford, Berks, Blair, Cambria, Carbon, Chester, Clinton, Columbia, Cumberland, Dauphin, Delaware, Fayette, Franklin, Fulton, Greene, Huntingdon, Juniata, Lancaster, Lebanon, Lehigh, Lycoming, Mifflin, Montour, Montgomery, Northampton, Northumberland, Perry, Philadelphia, Schuylkill, Snyder, Somerset, Union, Washington, Westmoreland, and York Counties
September 2003	Presidential Disaster Declaration - Hurricane Isabel/Henri	1497	All counties
September 1999	Presidential Disaster Declaration – Tropical Depression Dennis and Flash Flooding	1298	Lycoming, Northumberland, Snyder, and Union
September 1999	Presidential Disaster Declaration - Hurricane Floyd	1294	All counties
January 1996	Presidential Disaster Declaration - Flooding	1093	All counties
January 1996	Presidential Disaster Declaration - Severe Winter Storms	1085	Adams, Allegheny, Armstrong, Beaver, Bedford, Berks, Blair, Bradford, Bucks, Cambria, Cameron, Carbon, Centre, Chester, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Delaware, Elk, Fayette, Franklin, Fulton, Greene, Huntingdon, Indiana, Jefferson, Juniata, Lackawanna, Lancaster, Lebanon, Lehigh, Lycoming, Luzerne, McKean, Mifflin, Monroe, Montgomery, Montour, Northampton, Northumberland, Perry, Philadelphia, Pike, Potter, Schuylkill, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Wayne, Westmoreland, Wyoming and York Counties - Public Assistance; All 67 counties declared for Individual Assistance
January and February 1994	Presidential Disaster Declaration - Severe Winter Storms	1015	All counties
March 1993	Emergency Declaration – Blizzard	3105	All counties

Table 4.2-1 Presidential Disaster and Emergency Declarations affecting Lycoming County.			
DATE	**DECLARATION AND EVENT TYPE**	**DECLARATION NUMBER**	**AFFECTED AREAS**
June 1985	Presidential Disaster Declaration – Severe Storms, High Winds, and Tornadoes	737	Beaver, Butler, Clearfield, Crawford, Erie, Forest, Lycoming, McKean, Mercer, Northumberland, Union, Venango, and Warren
September 1975	Presidential Disaster Declaration - Flood (Eloise)	485	Adams, Berks, Bradford, Centre, Clinton, Columbia, Cumberland, Dauphin, Franklin, Juniata, Lackawanna, Lancaster, Lebanon, Luzerne, Lycoming, Mifflin, Montour, Northampton, Perry, Potter, Schuylkill, Snyder, Sullivan, Susquehanna, Tioga, Union, Wayne, Wyoming and York Counties
June 1972	Presidential Disaster Declaration - Flood (Agnes)	340	All counties
August 1965	Presidential Disaster Declaration - Water Shortage	206	Numerous counties statewide (no list available)
August 1955	Presidential Disaster Declaration – Floods, Rains	40	Northeaster Counties (no list available)

4.2.1. Summary of Hazards

As described in Section 4.1, at the initiation of the plan update process, the Steering Committee reviewed the Pennsylvania Standard List of Hazards to evaluate new and changing hazards in Lycoming County. Following a review of the hazards considered in the 2010 HMP, the 2013 Standard State All-Hazard Mitigation Plan, and the Standard List of Hazards, the Steering Committee decided that the 2014 plan update should identify, profile, and analyze 14 hazards. The hazards include all hazards profiled in the 2010 plan and the addition of Dam Failure, Disorientation, Levee Failure, and Radon Exposure as hazards of concern. Table 4.2-2 contains a complete list of the 14 hazards identified for hazard profiling in the 2015 HMP Update. Hazard profiles are included in Section 4.3 for each of these hazards.

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
NATURAL	
Drought	Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. This hazard is of particular concern in Pennsylvania due to the presence of farms as well as water-dependent industries and recreation areas across the Commonwealth. A prolonged drought could severely impact these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses. (National Drought Mitigation Center, 2006).
Earthquake	An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake. (FEMA, 1997).
Flood, Flash Flood, Ice Jam	Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period of time. 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. The severity of a flood event is dependent upon a combination of stream and river basin topography and physiography, hydrology, precipitation and weather patterns, present soil moisture conditions, the degree of vegetative clearing as well as the presence of impervious surfaces in and around flood-prone areas. (NOAA, 2009). Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure (USACE, 2007).

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
Hailstorm	In addition to flooding and severe winds, hail is another potential damaging product of severe thunderstorms. Hailstorms occur when ice crystals form within a low pressure front due to the rapid rise of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation in the form of balls or irregularly shaped masses of ice greater than 0.75 inches in diameter (FEMA, 1997). The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Damage to crops and vehicles are typically the most significant impacts of hailstorms. Areas in eastern and central Pennsylvania typically experience less than 2 hailstorms per year while areas in western Pennsylvania experience 2-3 annually.
Radon Exposure	Radon is a cancer-causing natural radioactive gas that you can't see, smell, or taste. It is a large component of the natural radiation that humans are exposed to and can pose a serious threat to public health when it accumulates in poorly ventilated residential and occupation settings. According to the USEPA, radon is estimated to cause about 21,000 lung cancer deaths per year, second only to smoking as the leading cause of lung cancer (EPA 402-R-03-003: EPA Assessment…, 2003). An estimated 40% of the homes in Pennsylvania are believed to have elevated radon levels (Pennsylvania Department of Environmental Protection, 2009).
Subsidence, Sinkhole	Subsidence is a natural geologic process that commonly occurs in areas with underlying limestone bedrock and other rock types that are soluble in water. Water passing through naturally occurring fractures dissolves these materials leaving underground voids. Eventually, overburden on top of the voids causes a collapse which can damage structures with low strain tolerances. This collapse can take place slowly over time or quickly in a single event, but in either case. Karst topography describes a landscape that contains characteristic structures such as sinkholes, linear depressions, and caves. In addition to natural processes, human activity such as water, natural gas, and oil extraction can cause subsidence and sinkhole formations. (FEMA, 1997).

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
Tornado, Wind Storm	A wind storm can occur during severe thunderstorms, winter storms, coastal storms, or tornadoes. Straight-line winds such as a downburst have the potential to cause wind gusts that exceed 100 miles per hour. Based on 40 years of tornado history and over 100 years of hurricane history, FEMA identifies western and central Pennsylvania as being more susceptible to higher winds than eastern Pennsylvania. (FEMA, 1997). A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes or tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of high wind velocities and wind-blown debris. According to the National Weather Service, tornado wind speeds can range between 30 to more than 300 miles per hour. They are more likely to occur during the spring and early summer months of March through June and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small, short-lived tornadoes can inflict tremendous damage. Destruction ranges from minor to catastrophic depending on the intensity, size, and duration of the storm. Structures made of light materials such as mobile homes are most susceptible to damage. Waterspouts are weak tornadoes that form over warm water and are relatively uncommon in Pennsylvania. Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002). Based on NOAA Storm Prediction Center Statistics, the number of recorded F3, F4, & F5 tornadoes between 1950-1998 ranges from <1 to 15 per 3,700 square mile area across Pennsylvania (FEMA, 2009). A water spout is a tornado over a body of water (American Meteorological Society, 2009).
Wildfire	A wildfire is a raging, uncontrolled fire that spreads rapidly through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. Wildfires can occur at any time of the year, but mostly occur during long, dry hot spells. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness, negligence, and ignorance. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion. Wildfires in Pennsylvania can occur in fields, grass, brush, and forests. 98% of wildfires in Pennsylvania are a direct result of people, often caused by debris burns (PA DCNR, 1999).
Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. 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. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility and disrupt transportation. The Commonwealth of Pennsylvania has a long history of severe winter weather. (NOAA, 2009).

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
HUMAN-MADE	
Dam Failure	A dam is a barrier across flowing water that obstructs, directs, or slows down water flow. Dams provide benefits such as flood protection, power generation, drinking water, irrigation, and recreation. Failure of these structures results in an uncontrolled release of impounded water. Failures are relatively rare, but immense damage and loss of life is possible in downstream communities when such events occur. Aging infrastructure, hydrologic, hydraulic and geologic characteristics, population growth, and design and maintenance practices should be considered when assessing dam failure hazards. The failure of the South Fork Dam, located in Johnstown, PA, was the deadliest dam failure ever experienced in the United States. It took place in 1889 and resulted in the Johnstown Flood which claimed 2,209 lives (FEMA, 1997). Today there are approximately 3,200 dams and reservoirs throughout Pennsylvania (Pennsylvania Department of Environmental Protection, 2009).
Disorientation	Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. Search and rescue efforts are focused in and around state forest and state park lands (DCNR, 2009).
Environmental Hazards – Natural Gas Drilling Incidents	Environmental hazards are hazards that pose threats to the natural environment, the built environment, and public safety through the diffusion of harmful substances, materials, or products. For the purposes of the Lycoming County HMP, this profile includes natural gas well incidents. This includes the release of the release of harmful chemical and waste materials into water bodies or the atmosphere, explosions, fires, and other hazards and threats to life safety stemming from oil and gas extraction(Environmental Protection Agency, Natural Disaster PSAs, 2009).
Levee Failure	A levee is a human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding (Interagency Levee Policy Review Committee, 2006). Levee failures or breaches occur when a levee fails to contain the floodwaters for which it is designed to control or floodwaters exceed the height of the constructed levee. 51 of Pennsylvania's 67 counties have been identified as having at least one levee (FEMA Region III, 2009).

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
Nuclear Incident	Nuclear incidents generally refer to events involving the release of significant levels of radioactivity or exposure of workers or the general public to radiation (FEMA, 1997). Nuclear accidents/incidents can be placed into three categories: 1) Criticality accidents which involve loss of control of nuclear assemblies or power reactors, 2) Loss-of-coolant accidents which result whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system, and 3) Loss-of-containment accidents which involve the release of radioactivity. The primary concern following such an incident or accident is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects. (FEMA, 1997).
Terrorism	Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons (FEMA, 2009). Increasingly, cyber-attacks have become a more pressing concern for governments across America.
Transportation Accident	Transportation accidents can result from any form of air, rail, water, or road travel. It is unlikely that small accidents would significantly impact the larger community. However, certain accidents could have secondary regional impacts such as a hazardous materials release or disruption in critical supply/access routes, especially if vital transportation corridors or junctions are present. Traffic congestion in certain circumstances can also be hazardous. Traffic congestion is a condition that occurs when traffic demand approaches or exceeds the available capacity of the road network. This hazard should be carefully evaluated during emergency planning since it is a key factor in timely disaster or hazard response, especially in areas with high population density. (Federal Highway Administration, 2009).

Table 4.2-2 Definition of hazards profiled in the 2014 Lycoming County HMP Update.	
PROFILED HAZARDS	**DESCRIPTION**
Utility Interruption	Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications, public works, and information network sectors. Utility interruption hazards include the following: • **Fuel or Resource Shortage**; resulting from supply chain breaks or secondary to other hazard events, for example (Mercer County, PA, 2005). • **Electromagnetic Pulse**; originating from an explosion or fluctuating magnetic field and causing damaging current surges in electrical and electronic systems (Institute for Telecommunications Sciences, 1996). • **Information Technology Failure**; due to software bugs, viruses, or improper use (Rainer Jr., et al, 1991). • **Ancillary Support Equipment**; electrical generating, transmission, system-control, and distribution-system equipment for the energy industry (Hirst & Kirby, 1996). • **Public Works Failure**; damage to or failure of highways, flood control systems, deepwater ports and harbors, public buildings, bridges, dams, for example (United States Senate Committee on Environment and Public Works, 2009). • **Telecommunications System Failure**; Damage to data transfer, communications, and processing equipment, for example (FEMA, 1997) • **Transmission Facility or Linear Utility Accident**; liquefied natural gas leakages, explosions, facility problems, for example (United States Department of Energy, 2005) • **Major Energy, Power, Utility Failure**; interruptions of generation and distribution, power outages, for example (United States Department of Energy, 2000). Internet interruptions/internet failures are an increasingly important kind of utility interruption as more of the day-to-day business of the Commonwealth is conducted over the internet.

4.3. Hazard Profiles and Vulnerability Analysis

Disaster frequency and its effects or severity are an important basis for planning emergency response and mitigation. Natural hazards tend to reoccur on a predictable seasonal basis, whereas human-caused or technological events tend to change over time with advancements in technology and methods of operation.

As defined in the Pennsylvania Standard Operating Guide, five criteria were used to assure a systematic and comprehensive approach to hazard analysis:

- **Location and Extent**: The location and extent of the County's vulnerability to a certain hazard can vary throughout the County. The maximum threat or worst-case disaster should be considered for each hazard. However, secondary effects of many hazards can be just as devastating. These secondary effects cause many hazards to become regional hazards affecting many areas with differing impacts.
- **Range of Magnitude**: Each individual hazard poses certain threats to the County and its municipalities. It is important to identify which hazards pose the greatest threat and focus mitigation actions toward those hazards.
- **Past Occurrences**: A record of past events is particularly helpful to evaluate hazards. Past records of the County's hazards also offer valuable information when tempered with the knowledge of preventative efforts, changes in preventative efforts, and advancements in technology that may reduce the frequency or severity of such events.
- **Future Occurrences**: The probability of an occurrence in the future is another important factor to consider when preparing for an all-hazards response. An event that occurs annually with relatively minor impact may deserve more emphasis than a major event that occurs once every 50 to 100 years.
- **Vulnerability Assessment**: The susceptibility of a community to destruction, injury, or death resulting from a hazard event defines the degree of vulnerability. The degree of vulnerability may be related to geographic location, as with floodplains, the type of facilities or structures, or the socioeconomics of a given area. Additionally, certain population groups may be more vulnerable to some hazards because of immobility or their inability to take protective action. The vulnerability assessment section of each hazard profile lists the buildings, critical infrastructure, and populations (where appropriate) within the respective hazard areas.

NATURAL HAZARDS

4.3.1. Drought

For layman's purposes, a drought is defined as a prolonged period of insufficient precipitation. However, drought conditions are qualified in different ways, depending upon the group impacted. A soil moisture deficit that inhibits crop production is typically referred to as an "agricultural drought." Whereas agricultural droughts may result from a rapid depletion of soil moisture, hydrological droughts often take months to fully materialize, as groundwater levels slowly decline and water storage decreases. Clearly, operational definitions are necessary to develop a common understanding of drought and its impacts. Operational definitions help hydrologists determine the onset, severity, and impact of droughts, which vary with the type of moisture deficit. Although climate is a primary contributor to hydrological drought, the construction of dams, deforestation, and land degradation all affect the hydrological system.

Drought can be broadly defined as a time period of prolonged dryness that contributes to the depletion of ground and surface water. There are three types:

Meteorological Drought – A deficiency in moisture in the atmosphere. This will have very little effect on the crops and water supply, depending on the preceding conditions.

Agricultural Drought – Inhibits the growth of crops, because of a moisture deficiency in the soil. This type of drought, if persistent, can lead to a hydrologic drought.

Hydrologic Drought – A prolonged period of time without rainfall that can have adverse effects on agriculture, streams, lakes, and groundwater levels.

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

- Droughts have several effects:
- Depletion of consumable water supply
- Depletion of agricultural water supply
- Depletion of forest water and water used to fight forest fires
- Depletion of water for navigational and recreational purposes
- Depletion of water for natural irrigation (besides crops and forests)
- Poor water quality

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.

4.3.1.1. Location and Extent

Drought is a normal part of virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in

length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought.

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. 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. The spatial extent for areas of impact can range from localized areas in Pennsylvania to the entire Mid-Atlantic region. Areas with extensive agriculture uses are particularly vulnerable to drought. Areas along waterways will show drought conditions later than those areas away from waterways.

4.3.1.2. Range of Magnitude

Droughts can have varying effects, depending upon what month they occur, severity, duration and location. Some droughts may have their greatest impact on agriculture and even short term droughts, when coupled with extreme temperatures can be devastating. Others may impact water supply or other water use activities such as recreation. 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.

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

The Commonwealth uses five parameters to assess drought conditions:

1) Stream flows (compared to benchmark records)
2) Precipitation (measured as the departure from normal, 30 year average precipitation)
3) Reservoir storage levels in a variety of locations (especially three New York City reservoirs in upper Delaware River Basin)
4) Groundwater elevations in a number of counties (comparing to past month, past year and historic record)
5) The Palmer Drought Severity Index – a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature (see Table 4.3.1-1).

Table 4.3.1-1 **Palmer Drought Severity Index (PSDI) classifications (NDMC, 2014).**

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

In Pennsylvania, PEMA has primary responsibility for managing droughts with direct support from the Department of Environmental Protection (DEP). According to *Drought Management in Pennsylvania* (2102), 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 uses by 5 percent in the affected areas. Due to varying conditions, individual water suppliers or municipalities may be asking for more stringent conservation actions.

- **Drought Warning:** This phase involves a coordinated response to imminent drought conditions and potential water supply shortages through concerted voluntary conservation measures to avoid or reduce shortages, relieve stressed sources, develop new sources, and if possible, forestall the need to impose mandatory water use restrictions. The objective of voluntary water conservation measures during a drought warning is to reduce overall water uses by 10-15 percent in the affected areas. Due to varying conditions, individual water suppliers or municipalities may be asking for more stringent conservation actions.

- **Drought Emergency:** This stage is a phase of concerted management operations to marshal all available resources to respond to actual emergency conditions, to avoid depletion of water sources, to assure at least minimum water supplies to protect public health and safety, to support essential and high priority water uses and to avoid unnecessary economic dislocations. It is possible during this phase to impose mandatory restrictions on non-essential water uses that are provided in the Pennsylvania Code (Chapter 119), if deemed necessary and if ordered by the Governor of Pennsylvania. The

objective of water use restrictions (mandatory or voluntary) and other conservation measures during this phase is to reduce consumptive water use in the affected area by fifteen percent, and to reduce total use to the extent necessary to preserve public water system supplies, to avoid or mitigate local or area shortages and to assure equitable sharing of limited supplies.

In addition, local water rationing is an option for communities:

- **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.

Central Pennsylvania has averaged 3.4 dry periods (10 or more consecutive days having less than 0.01 inch of precipitation) per year from 1950 through 1992. The Pennsylvania Crop Insurance Education and Participation Program (a partnership of the US Department of Agriculture, the Pennsylvania Department of Agriculture, and Penn State University) estimated that drought was the top reason for crop failure in Pennsylvania from 1981-2009; roughly 59% of all crop failures were due to drought.

The drought of 1999 had a significant impact on Lycoming County's agricultural production. According to the Pennsylvania Agricultural Statistics Service, there are 145,500 acres of land under active farm use in Lycoming County. During the drought, Lycoming County farmers felt the negative impact. Although few public water companies in Pennsylvania instituted water rationing plans, Lycoming County faced mandatory nonessential water use restrictions. It demonstrated that drought is as much a social phenomenon as a climatic one. For instance, communities under a drought warning that do not comply with voluntary conservation measures (e.g. taking shorter showers, refraining from washing cars or watering lawns) may worsen drought conditions and force state officials to impose mandatory water use restrictions.

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; decrease in supply to fight fires
- 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 through loss in plants and plant diversity
- 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

Pennsylvania's most devastating drought in recent history began in the winter of 1999 and continued through the spring, summer, and fall months. What began as an agricultural drought advanced to a hydrologic drought, a more severe drought due to the period of time and water uses that were impacted. Throughout the summer of 1999, most of the Mid-Atlantic region was experiencing drought conditions. This drought was the worst to hit Pennsylvania in 10 years. A winter season of little snowfall, followed by a dry spring and summer, left stream and groundwater levels at an all-time low. Many of the state's groundwater observation wells were at emergency levels. The situation was so severe that Governor Ridge declared a drought emergency in 55 Pennsylvania counties, allowing mandatory water use restrictions to be enforced and public water suppliers to implement local water rationing plans. Although residential users were affected by the drought, Pennsylvania farmers suffered the greatest financial loss. A sustained period of low soil moisture stunted the growth of many cash grains throughout Pennsylvania. By September, the drought emergency declaration included all 67 counties and had introduced $5.3 million in interim assistance for Pennsylvania farmers. The U.S. Department of Agriculture followed suit, declaring Pennsylvania an agricultural disaster area and offering emergency loans through county farm service agencies. Table 4.3.1-2 displays the past drought events in Lycoming County from 1980 through 2012.

Table 4.3.1-2 **Past drought events in Lycoming County 1980-2012 (PA DEP 2014).**

DATE	DROUGHT STATUS	DATE	DROUGHT STATUS
Nov 18, 1980 - Apr 20, 1982	Emergency	Dec 16, 1998 – Jan 15, 1999	Emergency
Apr 26, 1985 - Jul 29, 1985	Watch	Jan 15, 1999 – March 15, 1999	Emergency
Jul 29, 1985 - Oct 22, 1985	Watch	March 15, 1999 – June 10, 1999	Watch
Oct 22, 1985 - Oct 29, 1985	Watch	June 10, 1999 – June 18, 1999	Warning
Oct 29, 1985 - Dec 19, 1985	Watch	June 18, 1999 – July 20, 1999	Emergency
Jul 7, 1988 - Aug 24, 1988	Watch	July 20, 1999 – Sept 30, 1999	Watch
Aug 24, 1988 - Dec 12, 1988	Warning	Sept 30, 1999 – Dec 16, 1999	Watch
March 3, 1989 – May 15, 1989	Watch	Dec 16, 1999 - Feb 25, 2000	Watch
Jun 28, 1991 - Jul 24, 1991	Warning	Feb 25, 2000 - May 5, 2000	Watch
Jul 24, 1991 – Aug 16, 1991	Emergency	Aug 8, 2001 - Aug 24, 2001	Watch
Aug 16, 1991 - Sep 13, 1991	Emergency	Aug 24, 2001 - Nov 6, 2001	Watch
Sep 13, 1991 - Oct 21, 1991	Emergency	Nov 6, 2001 - Dec 5, 2001	Watch

Table 4.3.1-2 **Past drought events in Lycoming County 1980-2012 (PA DEP 2014).**			
DATE	**DROUGHT STATUS**	**DATE**	**DROUGHT STATUS**
Oct 21, 1991 - Jan 16, 1992	Emergency	Dec 5, 2001 - Feb 12, 2002	Watch
Jan 17, 1992 - Apr 20, 1992	Emergency	Feb 12, 2002 - May 13, 2002	Watch
April 20, 1992 – June 23, 1992	Warning	May 13, 2002 - June 14, 2002	Watch
Sep 1, 1995 - Sep 20, 1995	Warning	Sept 5, 2002 - Nov 7, 2002	Watch
Sep 20, 1995 - Nov 8, 1995	Emergency	April 11, 2006 - June 30, 2006	Watch
Nov 8, 1995 - Dec 18, 1995	Warning	Aug 6, 2007 – Sept 5, 2007	Watch
Jul 17, 1997 - Oct 27, 1997	Watch	Sept 5, 2007 – Oct 5, 2007	Watch
Oct 27, 1997 - Nov 13, 1997	Watch	Oct 5, 2007 - Jan 11, 2008	Watch
Nov 13, 1997 – Jan 16, 1998	Watch	Jan 11, 2008 - Feb 15, 2008	Watch
Dec 3, 1998 - Dec 8, 1998	Warning	Sept 16, 2010 - Nov 10, 2010	Watch
Dec 8, 1998 - Dec 14, 1998	Warning	Aug 5, 2011 – Sept 2, 2011	Watch
Dec 14, 1998 - Dec 16, 1998	Warning		

As can be seen in the table above, Lycoming County has not had a severe drought since 1999. According to DEP's Watershed Management Drought Information Center, the County has had eighteen drought watches in the period since the last drought emergency in the summer of 1999. A burn ban was issued for Lycoming County on April 16, 2006 due to extremely dry weather conditions. The USDA Risk Management Agency operates and manages the Federal Crop Insurance Corporation program. Since Lycoming County farms are eligible for crop insurance, it is possible to determine agricultural losses due to drought in the county. Table 4.3.1-3 displays the crop loss insurance payments by year due to drought (including even mild drought occurrences) since 1980.

Table 4.3.1-3 **Crop loss insurance compensation due to drought. (U.S. Dept. RMA)**	
CROP YEAR	**INDEMNITY AMOUNT ($)**
1952	$262.00
1982	$554.00
1999	$2,214.00
2002	$15,447.00
2005	$1,308.00
2007	$11,632.00
2010	$415.00
2011	$158,899.90
2012	$4,437.00
2013	$46,484.80
TOTAL	**241,653.70**

Of the crop losses summarized in Table 4.3.1-3, the crop that suffered the most substantial losses (as defined by indemnity amount) was corn. Table 4.3.1-4 provides the total indemnity amount by crop type for crop years 1952 through 2013.

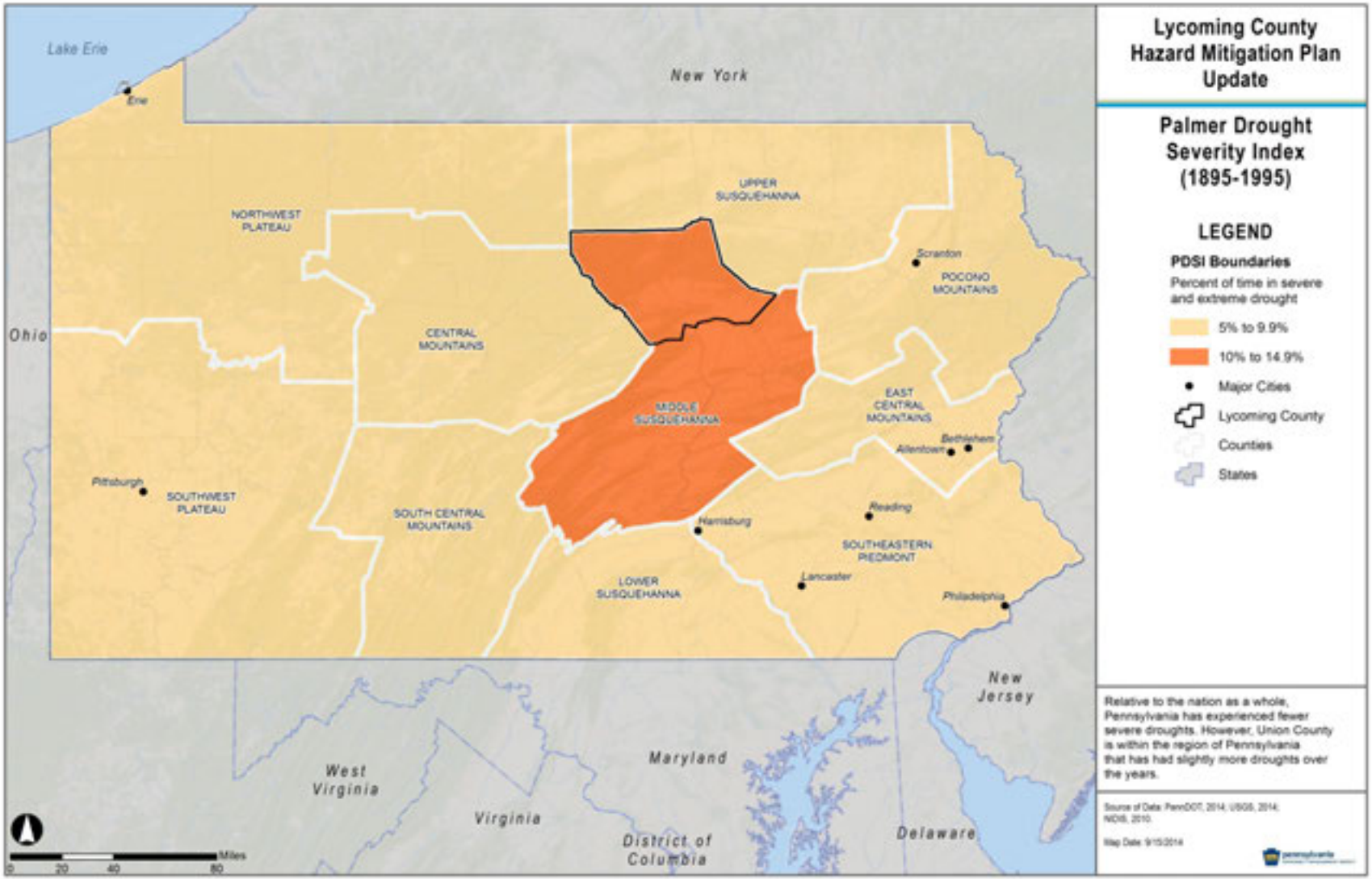
Table 4.3.1-4 **Crop loss insurance compensation by crop type (U.S. Dept. RMA)**

CROP	INDEMNITY AMOUNT ($)
Corn	$137,040.30
Soybeans	$60,473.40
Processing Beans	$41,601.00
Pears	$1,308.00
Wheat	$816.00
All Other Crops	$415.00
TOTAL	**241,653.70**

One way to measure the magnitude of a drought is through the Palmer Drought Severity Index. This index is based on several meteorological and hydrological factors, including temperature and soil moisture levels, and is computed weekly by the National Weather Service's Climate Prediction Center. The index compares precipitation received against the average amount expected during that period. Droughts are expressed as negative numbers. Palmer values of -2.00 to -2.99 indicate a watch status; values of -3.00 to -3.99 indicate a warning; and values of -4.00 and less indicate an emergency.

According to the Palmer Drought Severity Index, Lycoming County spent 10% to 14.9% of the time between 1895 and 1995 in a severe and extreme drought (i.e., Palmer values less than or equal to -3). Figure 4.3.1-1 displays these findings and Lycoming County in relation to other areas in Pennsylvania.

Figure 4.3.1-1 **Percent of time areas of the United States have PSDI values <= -3 (NDMC, 2009).**



4.3.1.4. Future Occurrence

The potential for a drought to occur in Lycoming County is high. Given the frequency of drought watches being issued for Lycoming County and its municipalities, the County can reasonably expect one to two drought watch periods each year. As stated above, Lycoming County spent 10% to 14.9% of the time between 1895 and 1995 in a severe and extreme drought; it can be assumed that the County will spend 10% to 14.9% of the future in these same drought conditions. While some form of drought condition frequently exists in Lycoming County, the impact depends on the duration of the event, severity of conditions, and area affected. On the whole, though, the probability of future drought events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.2-1).

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.

Drought has serious implications for the agricultural sector of Lycoming County's economy. According to the 2012 USDA Census of Agriculture, Lycoming County has 158,462 acres in 1,207 farms. The market value of all agricultural products sold exceeded $72.2 million in 2012; some or this entire product is at risk during a drought event. Lycoming County ranks 29th of the 67 counties in Pennsylvania in terms of the market value of agricultural products sold; in 2012, the market value of agricultural production topped $72 million. The county ranks seventh in tobacco; eleventh in cut Christmas trees and short rotation woody crops; and twelfth in nursery, greenhouse, floriculture, and sod in Pennsylvania by sales value (USDA, 2012). Other important crops include fruits, tree nuts, and berries; hogs and pigs; and other crops and hay. Table 4.3.1-5 lists the top livestock inventory items in Lycoming County. With these agricultural assets, drought events can severely impair the local economy with prolonged drought negatively impacting the livelihood of residents within agricultural communities particularly.

Table 4.3.1-5 **Top Livestock Inventory Items in Lycoming County (USDA, 2012).**

LIVESTOCK	COUNT
Pheasants	(D)
Pullets for laying flock replacement	67,630
Layers	21,220
Hogs and Pigs	16,836
Cattle and Calves	15,846
(D) Withheld 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 Lycoming 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 Lycoming County's vulnerability to other hazards such as severe weather, extreme heat, and public health emergencies. The special needs population of any county must also be considered during drought conditions.

Lycoming County residents that use private domestic wells are more vulnerable to droughts. Table 4.3.1-7 shows the number of domestic wells and the number of properties with public water access per municipality. It is important to note that the well data was obtained from the Pennsylvania Groundwater Information System (PaGWIS). **PaGWIS relies on voluntary submissions of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the County.** This is the most complete dataset of domestic wells available. The number of properties that are served by a public water provider was calculated from parcel/tax data. Approximately five percent of all properties within Lycoming County receive water from domestic wells. The highest percentage of properties with domestic wells, and subsequently more vulnerable to droughts, are located in Mill Creek Township; Cummings Township; Watson Township; and Bastress Township.

Table 4.3.1-6 **Number of domestic wells and properties served by public water by municipality (PaGWIS, 2014)**

MUNICIPALITY	NUMBER OF REPORTED DOMESTIC WELLS	NUMBER OF PROPERTIES WITH PUBLIC WATER	PERCENTAGE OF PROPERTIES WITH DOMESTIC WELLS	MUNICIPALITY	NUMBER OF REPORTED DOMESTIC WELLS	NUMBER OF PROPERTIES WITH PUBLIC WATER	PERCENTAGE OF PROPERTIES WITH DOMESTIC WELLS
Anthony Township	35	202	15%	Mill Creek Township	46	161	22%
Armstrong Township	23	226	9%	Montgomery Borough	0	487	0%
Bastress Township	35	161	18%	Montoursville Borough	1	1751	0%
Brady Township	17	165	9%	Moreland Township	30	235	11%
Brown Township	48	252	16%	Muncy Borough	0	869	0%
Cascade Township	8	123	6%	Muncy Creek Township	58	990	6%
Clinton Township	43	829	5%	Muncy Township	50	354	12%
Cogan House Township	27	257	10%	Nippenose Township	20	219	8%
Cummings Township	88	325	21%	Old Lycoming Township	57	1845	3%
Duboistown Borough	2	488	0%	Penn Township	12	293	4%
Eldred Township	71	639	10%	Piatt Township	40	341	10%
Fairfield Township	74	857	8%	Picture Rocks Borough	19	236	7%
Franklin Township	13	229	5%	Pine Township	34	227	13%
Gamble Township	18	255	7%	Plunketts Creek Township	14	352	4%

Table 4.3.1-6 **Number of domestic wells and properties served by public water by municipality (PaGWIS, 2014)**

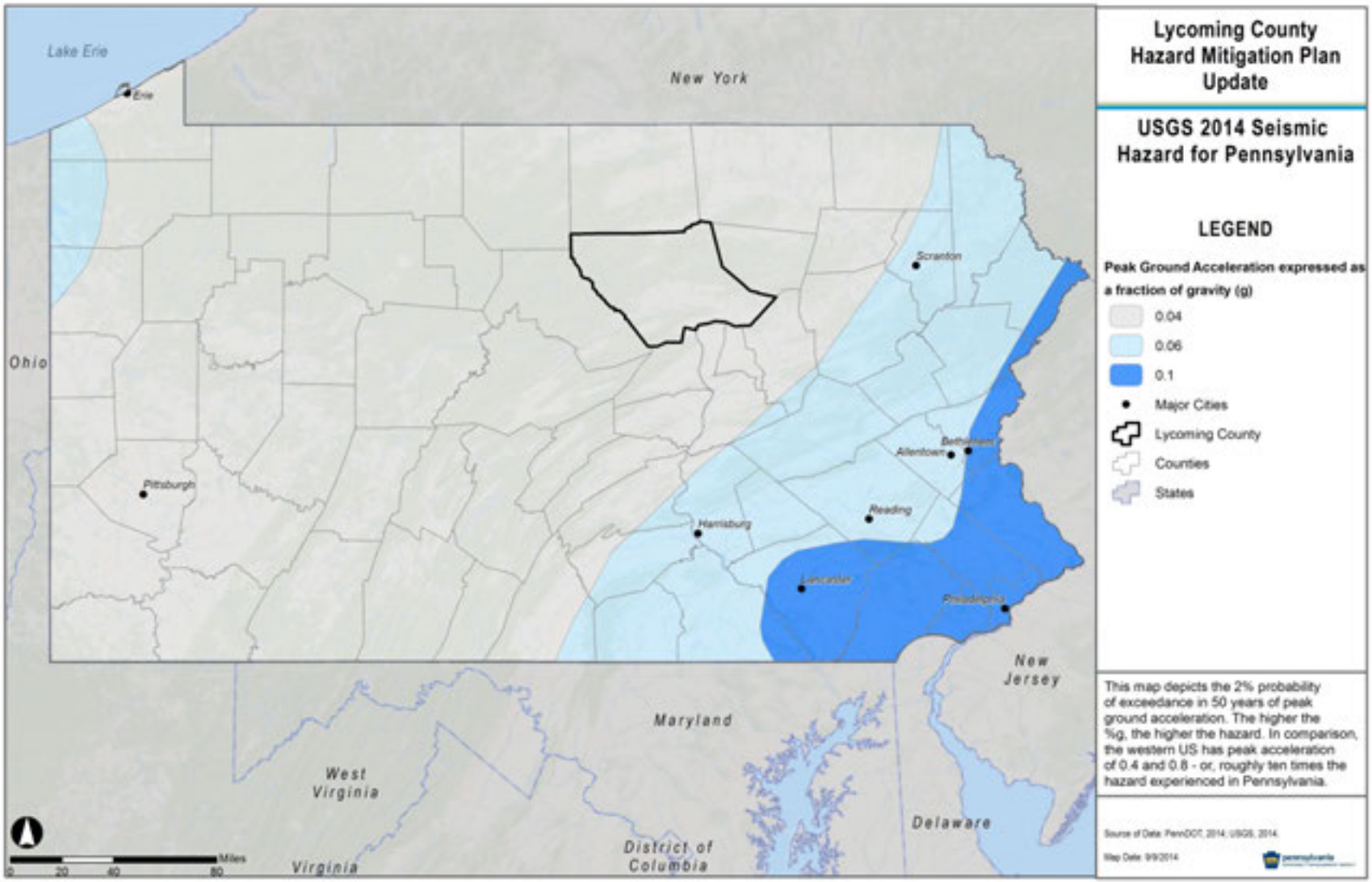
MUNICIPALITY	NUMBER OF REPORTED DOMESTIC WELLS	NUMBER OF PROPERTIES WITH PUBLIC WATER	PERCENTAGE OF PROPERTIES WITH DOMESTIC WELLS	MUNICIPALITY	NUMBER OF REPORTED DOMESTIC WELLS	NUMBER OF PROPERTIES WITH PUBLIC WATER	PERCENTAGE OF PROPERTIES WITH DOMESTIC WELLS
Hepburn Township	86	808	10%	Porter Township	31	565	5%
Hughesville Borough	2	676	0%	Salladasburg Borough	0	80	0%
Jackson Township	11	100	10%	Shrewsbury Township	13	154	8%
Jersey Shore Borough	0	1262	0%	South Williamsport Borough	18	2252	1%
Jordan Township	12	213	5%	Susquehanna Township	31	394	7%
Lewis Township	24	364	6%	Upper Fairfield Township	99	514	16%
Limestone Township	74	555	12%	Washington Township	45	495	8%
Loyalsock Township	31	3714	1%	Watson Township	54	239	18%
Lycoming Township	29	494	6%	Williamsport City	3	7319	0%
McHenry Township	88	429	17%	Wolf Township	28	845	3%
McIntyre Township	8	240	3%	Woodward Township	43	583	7%
McNett Township	4	82	5%	Unknown	300	0	100%
Mifflin Township	32	273	10%	**TOTAL**	**1,949**	**36,018**	**5%**

4.3.2. Earthquake

4.3.2.1. Location and Extent

Earthquake events in Pennsylvania typically do not impact areas greater than 100 km from the epicenter, and earthquake epicenters in Lycoming 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 2014 earthquake hazard in Pennsylvania and Lycoming County, expressed as the two-percent probability of exceedance in 50 years of peak ground acceleration (g). This map was digitized from the 2014 National Seismic Hazard report. Lycoming County lies in the 0.04 zone, indicating that the hazard is slight. Earthquakes originating from outside Pennsylvania, can also impact the Commonwealth, 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 **Approximate USGS Seismic Hazard for Pennsylvania (Petersen et al, 2014).**



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 summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. Based on historical events, earthquakes in the Pennsylvania region do not exceed magnitudes greater than 6.0. The worst-case earthquake in Lycoming County would therefore only result in trees swaying and objects falling off walls.

Table 4.3.2-1 **Richter scale magnitudes and associated earthquake size effects.**

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

The Richter Scale does not give any indication of the impact or damage of an earthquake, although it can be inferred that higher magnitude events cause more damage. Instead, the impact of an earthquake event is measured in terms of earthquake intensity, usually measured using the Modified Mercalli Intensity Scale, shown in Table 4.3.2-2. The earthquakes that occur in Pennsylvania originate deep within the earth's crust, not on an active fault. Therefore, little or no damage is expected. No injury or severe damage from earthquake events has been reported in Lycoming County.

Table 4.3.2-2 **Modified Mercalli Intensity Scale with associated impacts.**

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	**Instrumental**	Usually detected only on seismographs.	<4.2
II	**Feeble**	Felt only by a few persons at rest, especially on upper floors of buildings.	
III	**Slight**	Felt quite noticeably indoors, especially on upper floors. Most people don't recognize it as an earthquake (i.e. a truck rumbling).	
IV	**Moderate**	Can be felt by people walking; dishes, windows, and doors are disturbed.	
V	**Slightly Strong**	Sleepers are awoken; unstable objects are overturned.	<4.8
VI	**Strong**	Trees sway; suspended objects swing; objects fall off shelves; damage is slight.	<5.4
VII	**Very Strong**	Damage is negligible in buildings of good design and construction, slight to moderate in well-built	<6.1

Table 4.3.2-2 Modified Mercalli Intensity Scale with associated impacts.			
SCALE	**INTENSITY**	**DESCRIPTION OF EFFECTS**	**CORRESPONDING RICHTER SCALE MAGNITUDE**
		ordinary structures, and considerable in poorly built or badly designed structures; some chimneys are broken.	
VIII	**Destructive**	Damage is slight in specially designed structures; considerable in ordinary, substantial buildings. Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	<6.9
IX	**Ruinous**	Some houses collapse, ground cracks, pipes break open; damage is considerable in specially designed structures; buildings are shifted off foundations.	
X	**Disastrous**	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed along with foundations. Ground cracks profusely; liquefaction and landslides widespread.	<7.3
XI	**Very Disastrous**	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed.	<8.1
XII	**Catastrophic**	Total destruction; trees fall; lines of sight and level are distorted; ground rises and falls in waves; objects are thrown upward into the air.	>8.1

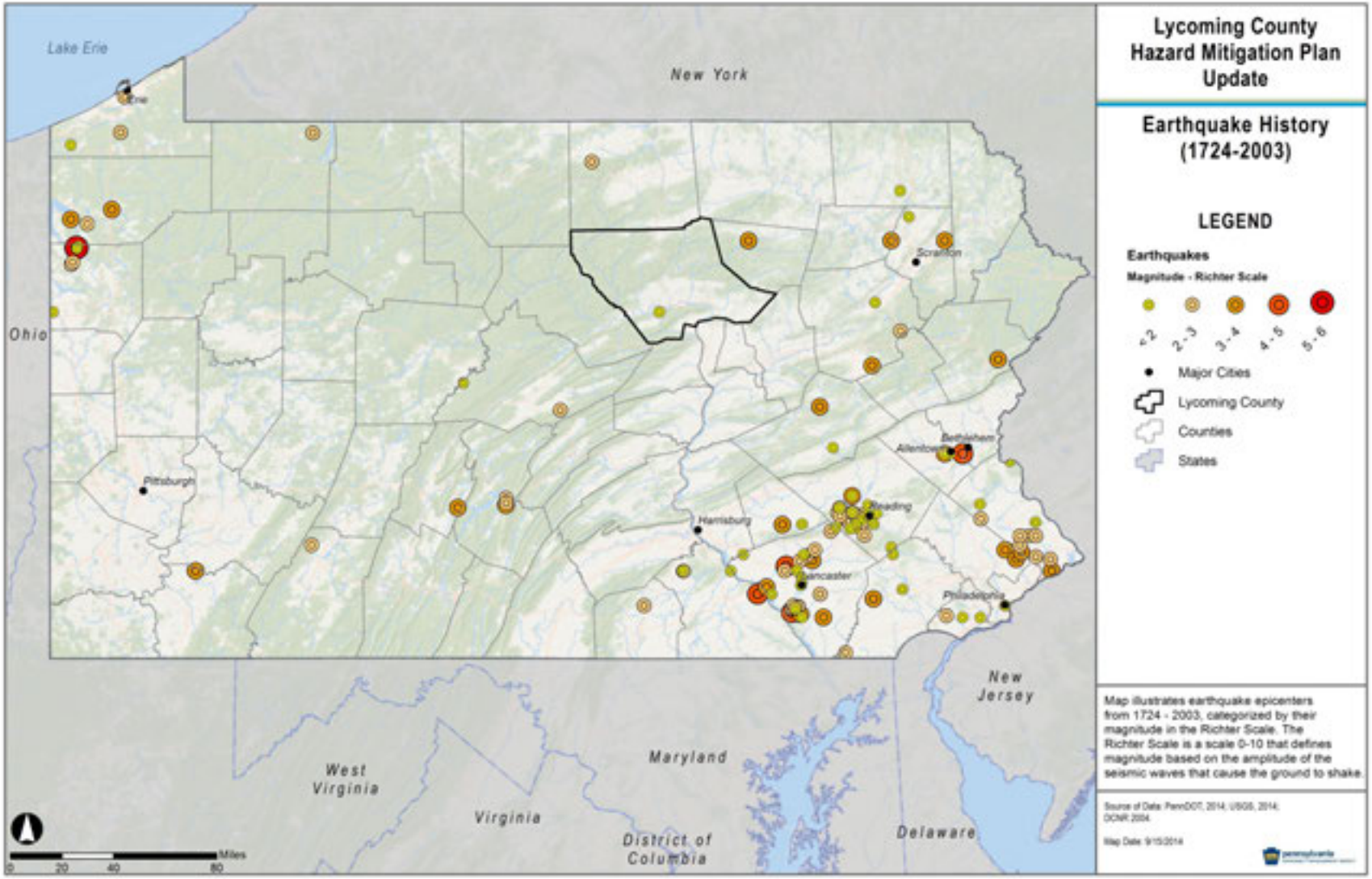
Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts like economic impacts are considered. Some examples of these impacts are listed below, but these impacts are unlikely to occur in Lycoming County:

1. Induced tsunamis and flooding or landslides and avalanches;
2. Poor water quality;
3. Damage to vegetation; and
4. Breakage in sewage or toxic material containments.

4.3.2.3. Past Occurrence

There was one earthquake registered within Lycoming County in 1907, however its magnitude was not measured, and no epicenters have occurred since. Figure 4.3.2-2 shows recorded earthquake epicenters in Pennsylvania between 1990 and 2003. Earthquake events are shown in other areas of Pennsylvania, with a particular concentration of events occurring in the eastern part of the Commonwealth between Lancaster and Reading. More recently, a magnitude 5.8 earthquake with an epicenter in rural Louisa County, VA was felt throughout Pennsylvania, triggering evacuations, emergency bridge and tunnel inspections, and minor damage to buildings. This shallow earthquake occurring along the Spotsylvania Fault was felt as far north as Ontario, Canada and as far south as Alabama. Additionally, there is a historical cluster of earthquakes between Lancaster and Reading, approximately 65 miles from Gettysburg. DCNR's earthquake records end in 2003, but a number of minor earthquakes have occurred in Pennsylvania and have been documented by USGS's Seismic Hazard Program.

Figure 4.3.2-2 **Map of earthquake epicenters in Pennsylvania (DCNR, 2004).**



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 percentage of the established rate of acceleration due to gravity. As shown in Figure 4.3.2-1, Lycoming County has a very low PGA ratio of 0.04. With a PGA this low, very little damage is expected, but soil conditions at local sites are extremely important in controlling how much damage will occur as a consequence of a given amount of ground acceleration. On the whole, though, the probability of future earthquake events can be considered *unlikely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.2.5. Vulnerability Assessment

Lycoming County is located in a zone where minor earthquake damage is expected. No damage or casualties have been reported from earthquake events. As a result, Lycoming County's vulnerability to earthquakes can be considered low. Major structural damage is not expected, but unanchored objects may fall or be otherwise disturbed.

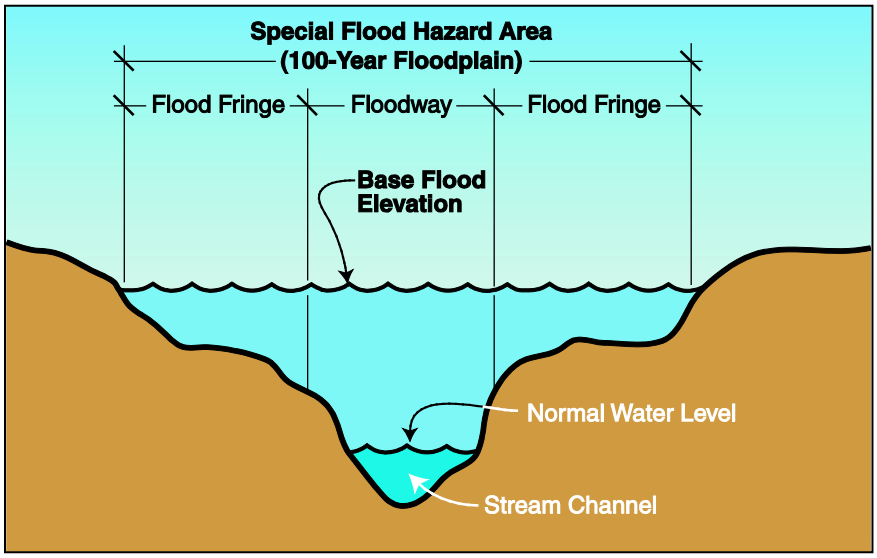
4.3.3. Flood, Flash Flood, Ice Jam

4.3.3.1. Location and Extent

A flood is a natural event for rivers and streams. For inland areas like south-central Pennsylvania, excess water from snowmelt or rainfall accumulates and overflows 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 4.3.4.4. However, in assessing the potential spatial extent of flooding it is important to know that a floodplain associated with a flood that has a 10 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 FIRMs 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 Lycoming County local governments.

Figure 4.3.3-1 **Diagram identifying Special Flood Hazard Area, 1%-annual-chance (100-Year) floodplain, floodway and flood fringe.**



Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories. In Pennsylvania, flooding occurs commonly and can occur 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. Most injuries and deaths from flooding happen when people are swept away by flood currents and most property damage results from inundation by sediment-filled water.

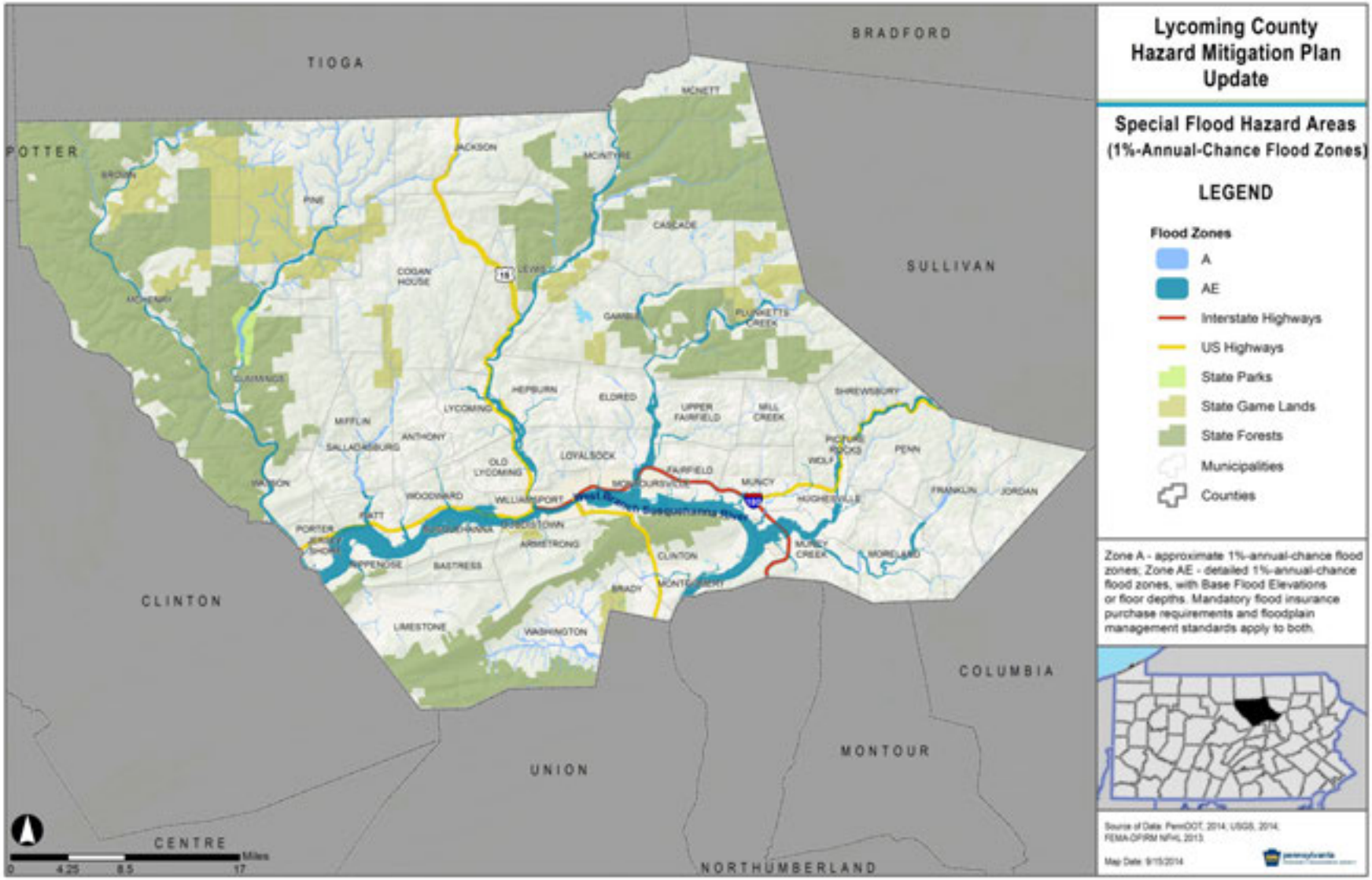
Flooding remains one of the most prevalent, costly, and damaging of all hazards facing the American public: “This century alone floods have caused a greater loss of life and property, and disrupted more families and communities than all other natural hazards combined,” (Laub et al., 1998). Most communities in the United States are subject to periodic flooding, whether as a result of dam failure (there are no high-hazard dams in Lycoming County), excessive precipitation, or inadequate drainage.

The most recent Effective Countywide DFIRMs were released for Lycoming County and all communities on March 16, 2004. Currently the County is undergoing another revision its FIRMs and FIS. Preliminary data for this most recent study is scheduled to be released on November 12, 2014. The current effective FIRMs, DFIRM data, and Flood Insurance Study (FIS) for Lycoming County can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov). These maps can be used to identify the expected spatial extent and elevation of flooding from a 1% and 0.2% annual chance event. All of the municipalities in the County participate in the NFIP. Portions of Lycoming County are currently being restudied through the Risk Mapping, Assessment, and Planning (MAP) effort at FEMA. Figure 4.3.3-2 shows the special flood hazard areas and watercourses of Lycoming County.

Several factors determine the severity of floods, including rainfall intensity and duration, topography and ground cover. A large amount of rainfall over a short time span can result in flash flood conditions. 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 impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

Pennsylvania has more stream miles than any other state, and many of its communities are located in floodplains. For waterfront communities, the level of risk constantly changes in response to unpredictable weather patterns and seasonal influences. Over 2,200 miles of stream traverse Lycoming County, more than any other county in Pennsylvania. Major flood-prone areas are communities located in low-lying valleys of major streams and tributaries. Unless protected by a dike or levee, most population concentrations along the Susquehanna River have a high possibility of flooding.

Figure 4.3.3-2 **Map showing Special Flood Hazard Areas in Lycoming County.**



4.3.3.2. Range of Magnitude

Floods are considered hazards when people and property are affected. 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. Injuries and deaths can occur when people are swept away by flood currents or bacteria and disease are spread by moving or stagnant floodwaters. Most property damage results from inundation by sediment-filled water. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover and rate of snowmelt. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover. Also, urbanization typically results in the replacement of vegetative ground cover with asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems.

In Central Pennsylvania, including Lycoming County, there are seasonal differences in the causes for floods. 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 has been 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.

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. These floods are often unpredictable and, particularly if they occur at night, can cause major panic and loss of life. 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. Also obstructions within the floodplain such as bridges and undersized culverts can also increase flooding.

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.

4.3.3.3. Past Occurrence

During the winter of 1996, unseasonably high temperatures began to melt an immense snow pack 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 Susquehanna River Basin was hit particularly hard. Ice jams on the Susquehanna River contributed to rapid water rises, the highest recorded in Harrisburg since 1890. Flood levels in the Lycoming Creek Basin reached 22.6 feet, two feet higher than flood stages recorded during tropical storm Agnes in 1972. Throughout Lycoming County, damage sustained from storms and floods exceeded $100 million. Six lives were lost in the Lycoming Creek Valley.

Table 4.3.3-1 contains information on flooding-related events since 1993 that impacted Lycoming County. These are the oldest floods for which data is available from the NCDC. Reported property damages are estimates reported to the NCDC and displayed in the Storm Events database today. So a zero dollar amount may not necessarily mean there was zero property damage, but that it could have simply not been reported. Similarly, the crop damage is only representative of what was reported to the NCDC.

Table 4.3.3-1 **Flood and flash flood events reported to the NCDC up to May 2014.**

LOCATION	DATE	TYPE	DEATH	INJURY	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
All Eastern Municipalities	11/28/1993	Flash Flood	0	0	0	0
Southeast Portion of County	7/24/1994	Flash Flood	0	0	0	0
County-wide	8/18/1994	Flash Flood	0	0	3,924,000	0
County-wide	10/21/1995	Flash Flood	0	0	0	0
County-wide	1/19/1996	Flash Flood	6	0	0	0
County-wide	1/19/1996	Flood	0	0	0	0
Western Section	11/8/1996	Flash Flood	0	0	0	0
Southeast	12/1/1996	Flash Flood	0	0	0	0
County-wide	12/13/1996	Flash Flood	0	0	0	0
County-wide	1/8/1998	Flash Flood	0	0	0	0
South Portion	2/18/1998	Flash Flood	0	0	0	0
Muncy	6/16/1998	Flash Flood	0	0	0	0
Southeast Portion	9/7/1999	Flash Flood	0	0	1,000,000	0
County-wide	9/16/1999	Flash Flood	0	0	20,000	0
County-wide	12/17/2000	Flash Flood	0	0	0	0
County-wide	3/26/2002	Flood	0	0	0	0
Montgomery	5/13/2002	Flash Flood	0	0	0	0
Elimsport	5/30/2002	Flash Flood	0	0	0	0
County-wide	3/20/2003	Flood	0	0	0	0
County-wide	11/20/2003	Flood	0	0	0	0
Southern Lycoming	3/7/2004	Flood	0	0	0	0
Muncy	5/26/2004	Flash Flood	0	0	0	0
Hughesville	7/31/2004	Flash Flood	0	0	0	0
County-wide	9/8/2004	Flood	0	0	0	0
Southern Lycoming	9/10/2004	Flood	0	0	0	0
County-wide	9/17/2004	Flood	0	0	0	0
Southern Lycoming	9/18/2004	Flood	0	0	0	0
Southern Lycoming	1/15/2005	Flood	0	0	0	0
Southern Lycoming	3/29/2005	Flood	0	0	0	0
County-wide	3/29/2005	Flood	0	0	0	0
County-wide	4/2/2005	Flood	0	0	0	0
Southern Lycoming	4/3/2005	Flood	0	0	0	0
Southern Lycoming	11/30/2005	Flood	0	0	0	0
Southern Lycoming	12/1/2005	Flood	0	0	0	0
Muncy Creek Township	8/29/2006	Flash Flood	0	0	0	0
Muncy Creek Township	11/16/2006	Flash Flood	0	0	0	0
Muncy	11/16/2006	Flash Flood	0	0	0	0
Cedar Run	3/5/2008	Flood	0	0	0	0
Jersey Shore	7/23/2009	Flash Flood	0	0	25,000	0

Table 4.3.3-1 **Flood and flash flood events reported to the NCDC up to May 2014.**

LOCATION	DATE	TYPE	DEATH	INJURY	PROPERTY DAMAGE ($)	CROP DAMAGE ($)
Jersey Shore	7/23/2009	Flood	0	0	0	0
Clarkstown	7/31/2009	Flash Flood	0	0	5,000	0
County-wide	1/25/2010	Flood	0	0	0	0
Jersey Shore	12/1/2010	Flood	0	0	10,000	0
Garden View	3/6/2011	Flood	0	0	0	0
Quiggleville	3/10/2011	Flood	0	0	0	0
Muncy	3/11/2011	Flood	0	0	0	0
Muncy	4/28/2011	Flood	0	0	0	0
Picture Rocks	9/7/2011	Flood	0	0	11,000,000	0
Montgomery	9/28/2011	Flash Flood	0	0	0	0
Garden View	7/28/2012	Flash Flood	0	0	100,000	0
		TOTALS:	**8**	**0**	**$4,944,000**	**0**

The National Flood Insurance Program identifies properties that frequently experience flooding. *Repetitive loss properties* are structures insured under the NFIP which have had at least two paid flood losses of more than $1,000 over any ten year period since 1978. A property is considered a *severe repetitive loss property* either when there are at least four losses each exceeding $5,000 and cumulatively exceeding $20,000 or when there are two or more losses where the building payments exceed the property value. According to the 2013 Pennsylvania State Hazard Mitigation Plan, there were 549 repetitive loss properties in Lycoming County, 75 of which have been mitigated (PEMA, 2013). Of the mitigated properties, 65 were single family homes, five were 2-4 family dwellings, three were non-residential, one was considered 'other residential' and one was a condo. Old Lycoming Township has by far the most repetitive loss properties with 100 in that jurisdiction alone. Table 4.3.3-2 shows the number of repetitive loss properties by municipality.

Table 4.3.3-2 **Summary of the number and type of Repetitive Loss properties by municipality (PEMA, 2013). Please note that only communities with Repetitive Loss properties are shown.**

MUNICIPALITY	TYPE					SUM OF REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	ASSEMBLED CONDO	NON-RESIDENTIAL	OTHER RESIDENTIAL	SINGLE FAMILY	
Armstrong Township	0	0	0	1	2	3
Brown Township	0	0	0	0	1	1
Clinton Township	0	0	1	0	5	6
Cummings Township	0	0	0	0	8	8
Duboistown Borough	0	0	0	1	2	3
Fairfield Township	0	1	1	1	8	11
Hepburn Township	3	0	2	0	38	43
Hughesville Borough	0	0	0	0	1	1

Table 4.3.3-2 **Summary of the number and type of Repetitive Loss properties by municipality (PEMA, 2013). Please note that only communities with Repetitive Loss properties are shown.**

MUNICIPALITY	TYPE					SUM OF REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	ASSEMBLED CONDO	NON-RESIDENTIAL	OTHER RESIDENTIAL	SINGLE FAMILY	
Jersey Shore Borough	5	1	3	0	21	30
Lewis Township	1	0	2	0	24	27
Loyalsock Township	4	2	0	0	27	33
Lycoming Township	0	0	2	0	37	39
Mchenry Township	0	0	0	0	5	5
Mcintyre Township	0	0	1	0	10	11
Mcnett Township	0	0	0	0	1	1
Mifflin Township Of	0	0	0	0	1	1
Montgomery Borough	3	1	2	0	12	18
Montoursville Borough	4	2	3	1	17	27
Moreland Township	0	0	0	0	2	2
Muncy Creek Township	2	3	4	0	11	20
Muncy Borough	8	1	2	1	53	65
Muncy Township	0	0	1	0	0	1
Old Lycoming Township	4	1	1	0	94	100
Penn Township	0	1	0	0	1	2
Piatt Township	1	1	0	0	7	9
Pine Township	0	0	0	0	3	3
Plunketts Creek Township	0	0	2	0	20	22
Porter Township	0	1	0	0	0	1
Shrewsbury Township	0	0	1	0	0	1
South Williamsport Borough	1	0	0	0	5	6
Susquehanna Township	0	0	0	0	7	7
Upper Fairfield Township	1	0	0	0	17	18
Watson Township	0	1	0	0	4	5
Williamsport, City of	2	0	0	0	10	12
Woodward Township	0	0	0	0	7	7
LYCOMING COUNTY TOTAL	**39**	**16**	**28**	**5**	**461**	**549**

There are also 27 severe repetitive loss properties spread throughout Lycoming County. Two of these properties have been mitigated as of 2013. Table 4.3.3-3 shows the number of severe repetitive loss properties by municipality.

Table 4.3.3-3 **Summary of the number and type of Repetitive Loss properties by municipality (PEMA, 2013). Please note that only communities with Repetitive Loss properties are shown.**

MUNICIPALITY	TYPE					SUM OF SEVERE REPETITIVE LOSS PROPERTIES
	2-4 FAMILY	ASSEMBLED CONDO	NON-RESIDENTIAL	OTHER RESIDENTIAL	SINGLE FAMILY	
Fairfield Township	0	0	0	0	1	1
Hepburn Township	0	0	0	0	4	4
Lewis Township	0	0	0	0	3	3
Loyalsock Township	1	0	0	0	5	5
Lycoming Township	0	0	0	0	4	4
Montgomery Borough	1	0	0	0	1	1
Muncy Borough	0	0	0	0	4	1
Muncy Creek Township	1	0	0	0	1	4
Old Lycoming Township	1	0	0	0	3	3
Upper Fairfield Township	0	0	0	0	1	1
LYCOMING COUNTY TOTAL	**4**	**0**	**0**	**0**	**23**	**27**

Floods are the most common and costly natural catastrophe in the United States. In terms of economic disruption, property damage, and loss of life, floods are “nature’s number-one disaster.” For that reason, flood insurance is almost never available under industry-standard homeowner’s and renter’s policies. The best way for citizens to protect their property against flood losses is to purchase flood insurance through the NFIP.

Congress established the NFIP in 1968 to help control the growing cost of federal disaster relief. The NFIP is administered by the FEMA, part of the U.S. Department of Homeland Security. The NFIP offers federally-backed flood insurance in communities that adopt and enforce effective floodplain management ordinances to reduce future flood losses.

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

Today, nearly 90 WYO insurance companies issue and service the SFIP under their own names. More than 4.4 million federal flood insurance policies are in force. These policies

represent $650 billion in flood insurance coverage for homeowners, renters, and business owners throughout the United States and its territories.

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 of the municipalities in Lycoming County are participating in the Regular Program.

The minimum floodplain management requirements include:

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

In addition, Regular Program communities are eligible to participate in the NFIP's CRS Program. Under the CRS, policyholders can receive premium discounts of 5 to 45 percent as their cities and towns adopt more comprehensive flood mitigation measures. Currently, Jersey Shore Borough is the only municipality in Lycoming County participating in CRS, having a Class 9 rating.

Table 4.3-1 shows the number of NFIP policies, claims and a comparison of number of structures in the SFHA verses number of policies in place by municipality. It should be noted that specific location information for policies is not available and therefore not all policies may be associated with structures that are located in the SFHA. Likewise, certain areas previously

designated as SFHA on the Lycoming County DFIRM have been removed and are now shown as Zone X on the preliminary FIRM.

Table 4.3-1 NFIP Policies and Claims in Lycoming County. FEMA CIS 2014.

MUNICIPALITY	# OF STRUCTURES IN SFHA	# POLICIES	% POLICIES COMPARED TO # OF STRUCTURES IN SFHA*	# CLAIMS	# SUBSTANTIAL DAMAGE CLAIMS
Anthony Township	8	1	12.5%	0	0
Armstrong Township	70	17	24.3%	25	5
Bastress Township	0	0	0.0%	0	0
Brady Township	5	1	20.0%	3	0
Brown Township	51	16	31.4%	3	1
Cascade Township	33	3	9.1%	1	1
Clinton Township	176	23	13.1%	25	2
Cogan House Township	28	3	10.7%	1	0
Cummings Township	238	74	31.1%	58	5
Duboistown Borough	96	34	38.5%	30	2
Eldred Township	29	18	62.1%	14	3
Fairfield Township	31	11	35.5%	45	11
Franklin Township	63	6	9.5%	4	1
Gamble Township	18	11	61.1%	12	3
Hepburn Township	150	68	45.3%	216	41
Hughesville Borough	2	15	750.0%	10	0
Jackson Township	13	0	0.0%	0	0
Jersey Shore Borough	1,142	455	39.8%	212	3
Jordan Township	11	3	27.3%	1	0
Lewis Township	268	66	24.6%	180	31
Limestone Township	73	10	13.7%	0	0
Loyalsock Township	272	136	50.0%	245	26
Lycoming Township	321	99	30.8%	230	43
McHenry Township	135	29	21.5%	32	0
McIntyre Township	129	26	20.2%	52	8
McNett Township	15	3	20.0%	3	0
Mifflin Township	140	23	16.4%	3	0
Mill Creek Township	9	2	22.2%	0	0
Montgomery Borough	280	80	28.6%	96	2
Montoursville Borough	74	51	68.9%	126	16
Moreland Township	12	5	41.7%	11	2
Muncy Borough	457	242	24.9%	411	13
Muncy Creek Township	305	114	79.3%	152	15
Muncy Township	14	8	57.1%	3	1
Nippenose Township	68	14	20.6%	6	1
Old Lycoming Township	428	174	40.7%	539	95
Penn Township	29	8	27.6%	11	1
Piatt Township	246	49	19.9%	59	25
Picture Rocks Borough	10	10	100.0%	4	0
Pine Township	177	21	11.9%	20	7

Table 4.3-1 NFIP Policies and Claims in Lycoming County. FEMA CIS 2014.					
MUNICIPALITY	**# OF STRUCTURES IN SFHA**	**# POLICIES**	**% POLICIES COMPARED TO # OF STRUCTURES IN SFHA***	**# CLAIMS**	**# SUBSTANTIAL DAMAGE CLAIMS**
Plunketts Creek Township	126	86	68.3%	147	49
Porter Township	159	51	32.1%	14	0
Salladasburg Borough	32	3	9.4%	0	0
Shrewsbury Township	73	16	21.9%	10	2
South Williamsport Borough	109	67	61.5%	37	3
Susquehanna Township	263	44	16.7%	37	6
Upper Fairfield Township	67	21	31.3%	82	26
Washington Township	99	8	8.1%	0	0
Watson Township	154	62	40.3%	52	2
Williamsport, City of	74	59	79.7%	99	13
Wolf Township	72	26	36.1%	14	1
Woodward Township	161	30	18.6%	42	8
TOTAL	**7,015**	**2405**	**34.3%**	**3377**	**474**
***NFIP policies may be associated with properties located outside the SFHA.**					

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 National Flood Insurance Program (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 1 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. The term “100-year flood” is a misnomer. 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 1 percent chance of occurring in any given year.

Smaller floods occur more often than larger (deeper and more widespread) floods. Thus, a “10-year” flood has a greater likelihood of occurring than a “100-year” flood. Table 4.3.3-4 shows a range of flood recurrence intervals and their probabilities of occurrence.

The extent of flooding associated with a 1 percent probability of occurrence – the base flood – is used as a regulatory boundary by a number of federal, state, and local agencies. Also referred to as the “special flood hazard area,” this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities, since many communities like Lycoming

County have maps available that show the extent of the base flood and the likely depths that will be experienced.

Table 4.3.3-4 **Recurrence intervals and associated probabilities of occurrence (FEMA, 2007).**

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

Carved through glacial deposits and steep terrain, the Lycoming County tributaries of the Susquehanna River are characterized by high gradients and significant bedload movement. The steep slopes characteristic of the County's northern landscape contribute to increased stormwater runoff, particularly during wet weather events. The potential for flooding constantly changes in response to a stream's sediment load, discharge rates, and water levels. The back-water effect, in which the flooding of one waterway will result in flooding along waterways that join with it, is a common problem throughout the Susquehanna River's watershed.

Based on previous events, Lycoming County can expect between two and three flood events per year. However, future development may affect the flood likelihood and intensity. For example, development often comes hand in hand with an increase in impervious surface, which can intensify and increase flooding events. And though the County is expecting a population decrease, suggesting little future residential growth and therefore little increase in impervious surfaces, the County is experiencing a significant amount of development in the natural gas industry, which comes with a rather large footprint. Discussed in more detail in Section 4.3.10, the growth of the natural gas industry in Lycoming County significantly impacts the amount of impervious surface in the County and heightens its vulnerability to flooding. On the whole, though, the probability of future flood, flash flood, and ice jam events can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.3.5. Vulnerability Assessment

Despite the fact that all of Lycoming County's 52 municipalities participate in the National Flood Insurance Program (NFIP), communities need 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 that went undetected by the National Weather Service created surface flooding, which forced evacuations in several floodplain communities.

Throughout the years, stream improvement projects have been undertaken to reduce erosion and the threat to habitable structures along the creek. Approximately 100 properties within the

floodplain have been acquired and cleared in Old Lycoming, Hepburn, Lewis, Lycoming, Loyalsock, and McIntyre Townships.

The flood hazard vulnerability assessment for the County focused on the community assets that are located in the 1% chance floodplain. While greater and smaller floods are possible, information about the extent and depth for the 1% chance floodplain is available in a similar format for all 52 Lycoming County municipalities, providing a consistent basis for analysis. Table 4.3.3-6 shows the structures, critical facilities, and populations located in the SFHA; there are 7,015 structures in the SFHA county-wide (over 25% of all structures). Salladasburg Borough has the highest proportion of structures in the floodplain at over 75% of all structures vulnerable to flooding. Jersey Shore and Muncy Boroughs also have high proportions of structures in the SFHA. All critical facilities in Shrewsburg Township are located in the SFHA, but over half of all municipalities do not have any critical facilities in the floodplain. When looking at structures by property type, shown in Table 4.3.3-7, the majority of vulnerable structures are unsurprisingly residential in nature, followed by commercial and agricultural uses.

Besides looking at this vulnerability by municipality, it is important to understand the distribution of vulnerable properties by HUC 10 watersheds, which are the geographic basis of flood mitigation in Lycoming County. Table 4.3.3-5 shows the number of floodprone structures by HUC 10 watershed. Over half of all vulnerable structures are located in only two watersheds: Babb Creek and West Branch Susquehanna River.

Table 4.3.3-5 **Structures in the SFHA by HUC10 with corresponding WOGs.**

HUC10	HUC10 NAME	WOG	TOTAL STRUCTURES IN HUC10	STRUCTURES IN SFHA	PERCENT STRUCTURES IN SFHA IN HUC10
0205010602	Schrader Creek	Lycoming Creek	1	0	0.0%
0205010603	Towanda Creek	Lycoming Creek	26	2	7.7%
0205010706	Little Fishing Creek	Muncy Creek	235	1	0.4%
0205010707	Fishing Creek	Muncy Creek	5	0	0.0%
0205020303	Young Womans Creek	Pine Creek	49	0	0.0%
0205020304	Lower West Branch Susquehanna River	Pine Creek	101	0	0.0%
0205020504	Fishing Creek	West Branch Susquehanna River	11	0	0.0%
0205020505	Babb Creek	Pine Creek	1,182	248	21.0%
0205020506	Little Pine Creek	Pine Creek	3,396	541	15.9%
0205020601	Larrys Creek	Larrys Creek	1,838	280	15.2%
0205020602	Lycoming Creek	Lycoming Creek	10,122	1,535	15.2%
0205020605	Lower Loyalsock Creek	Loyalsock Creek	5,155	370	7.2%
0205020606	West Branch Susquehanna River	West Branch Susquehanna River	29,602	2,475	8.4%
0205020607	Little Muncy Creek	Muncy Creek	2,063	125	6.1%
0205020608	Muncy Creek	Muncy Creek	4,297	245	5.7%

Table 4.3.3-5 **Structures in the SFHA by HUC10 with corresponding WOGs.**

HUC10	HUC10 NAME	WOG	TOTAL STRUCTURES IN HUC10	STRUCTURES IN SFHA	PERCENT STRUCTURES IN SFHA IN HUC10
0205020609	White Deer Hole Creek	West Branch Susquehanna River	1,540	103	6.7%
0205020611	Chillisquaque Creek	Muncy Creek	22	0	0.0%
0205020612	West Branch Susquehanna River	West Branch Susquehanna River	4,146	1,090	26.3%
TOTAL			**63,791**	**7,015**	**11.0%**

Table 4.3.3-6 **Community flood vulnerability for Lycoming County.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA	PERCENT OF STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES IN MUNICIPALITY	TOTAL CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL 2010 POPULATION	2010 POPULATION IN SFHA*	PERCENT POPULATION IN SFHA
Anthony Township	389	8	2.1%	6	1	16.7%	865	27	3.1%
Armstrong Township	533	70	13.1%	2	0	0.0%	681	162	23.8%
Bastress Township	253	0	0.0%	4	0	0.0%	546	2	0.4%
Brady Township	351	5	1.4%	3	1	33.3%	521	0	0.0%
Brown Township	428	51	11.9%	4	0	0.0%	96	1	1.0%
Cascade Township	351	33	7.7%	4	0	0.0%	413	0	0.0%
Clinton Township	1,536	176	11.5%	21	3	14.3%	3,708	224	6.0%
Cogan House Township	1,044	28	2.7%	11	2	18.2%	955	23	2.4%
Cummings Township	843	238	28.1%	4	0	0.0%	273	136	49.8%
Duboistown Borough	733	96	13.1%	8	0	0.0%	1,205	109	9.0%
Eldred Township	968	29	3.0%	5	0	0.0%	2,122	24	1.1%
Fairfield Township	1,484	31	2.2%	12	0	0.0%	2,792	39	1.4%
Franklin Township	609	63	10.3%	10	0	0.0%	933	28	3.0%
Gamble Township	603	18	2.8%	4	1	25.0%	756	11	1.5%
Hepburn Township	1,467	150	10.2%	12	3	25.0%	2,762	199	7.2%
Hughesville Borough	967	2	0.1%	21	0	0.0%	2,128	10	0.5%
Jackson Township	331	13	4.2%	2	0	0.0%	396	47	11.9%
Jersey Shore Borough	2,356	1,142	48.9%	39	10	25.6%	4,361	2,112	48.4%
Jordan Township	565	11	1.9%	8	2	25.0%	863	22	2.5%
Lewis Township	820	268	32.7%	7	5	71.4%	987	445	45.1%
Limestone Township	1,397	73	5.2%	14	1	7.1%	2,019	21	1.0%
Loyalsock Township	5,344	272	5.1%	54	2	3.7%	11,026	271	2.5%

Table 4.3.3-6 **Community flood vulnerability for Lycoming County.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA	PERCENT OF STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES IN MUNICIPALITY	TOTAL CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL 2010 POPULATION	2010 POPULATION IN SFHA*	PERCENT POPULATION IN SFHA
Lycoming Township	966	321	33.3%	6	0	0.0%	1,478	538	36.4%
McHenry Township	728	135	18.5%	5	0	0.0%	143	4	2.8%
McIntyre Township	419	129	32.2%	8	1	12.5%	520	115	22.1%
McNett Township	254	15	5.9%	2	0	0.0%	174	2	1.1%
Mifflin Township	581	140	24.1%	6	0	0.0%	1,070	191	17.9%
Mill Creek Township	313	9	2.9%	4	0	0.0%	604	12	2.0%
Montgomery Borough	805	280	34.8%	14	4	28.6%	1,579	635	40.2%
Montoursville Borough	2,257	74	3.2%	32	2	6.3%	4,615	239	5.2%
Moreland Township	583	12	2.1%	7	0	0.0%	943	29	3.1%
Muncy Borough	1,117	457	40.8%	17	4	23.5%	2,477	958	38.7%
Muncy Creek Township	1,970	305	15.5%	21	3	14.3%	3,474	717	20.6%
Muncy Township	655	14	2.1%	14	0	0.0%	1,089	33	3.0%
Nippenose Township	558	68	12.2%	7	2	28.6%	709	156	22.0%
Old Lycoming Township	3,091	428	13.8%	22	1	4.5%	4,938	789	16.0%
Penn Township	573	29	5.1%	2	0	0.0%	960	4	0.4%
Piatt Township	866	246	28.5%	5	0	0.0%	1,180	232	19.7%
Picture Rocks Borough	300	10	3.3%	9	0	0.0%	678	13	1.9%
Pine Township	556	177	31.8%	3	0	0.0%	294	25	8.5%
Plunketts Creek Township	711	126	17.9%	7	0	0.0%	684	94	13.7%
Porter Township	870	159	17.0%	7	0	0.0%	1,601	327	20.4%
Salladasburg Borough	145	32	75.2%	2	0	0.0%	238	80	33.6%
Shrewsbury Township	298	73	10.7%	2	2	100.0%	409	70	17.1%

Table 4.3.3-6 **Community flood vulnerability for Lycoming County.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA	PERCENT OF STRUCTURES IN SFHA	TOTAL CRITICAL FACILITIES IN MUNICIPALITY	TOTAL CRITICAL FACILITIES IN SFHA	PERCENT CRITICAL FACILITIES IN SFHA	TOTAL 2010 POPULATION	2010 POPULATION IN SFHA*	PERCENT POPULATION IN SFHA
South Williamsport Borough	2,899	109	2.5%	28	0	0.0%	6,379	205	3.2%
Susquehanna Township	738	263	35.6%	6	2	33.3%	1,000	197	19.7%
Upper Fairfield Township	915	67	7.3%	14	0	0.0%	1,823	174	9.5%
Washington Township	1,298	99	7.6%	11	0	0.0%	1,619	103	6.4%
Watson Township	511	154	30.1%	1	0	0.0%	537	108	20.1%
Williamsport City	12,248	74	0.6%	129	1	0.8%	29,381	55	0.2%
Wolf Township	1,551	72	4.7%	15	0	0.0%	2,907	81	2.8%
Woodward Township	1,643	161	9.8%	14	0	0.0%	2,200	156	7.1%
TOTAL	**63,791**	**7,015**	**11.0%**	**675**	**53**	**7.9%**	**116,111**	**10,255**	**8.8%**

Table 4.3.3-7 **Structures in the SFHA by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Anthony Township	389	0	0	0	6	2	0	8
Armstrong Township	533	12	5	17	36	0	0	70
Bastress Township	253	0	0	0	0	0	0	0
Brady Township	351	0	2	0	2	0	1	5
Brown Township	428	0	5	0	42	0	4	51
Cascade Township	351	0	0	0	30	0	3	33
Clinton Township	1,536	24	15	0	125	1	11	176
Cogan House Township	1,044	1	3	0	21	0	3	28
Cummings Township	843	1	26	0	205	0	6	238
Duboistown Borough	733	0	17	0	79	0	0	96
Eldred Township	968	3	0	0	26	0	0	29
Fairfield Township	1,484	5	5	0	19	1	1	31
Franklin Township	609	0	32	1	30	0	0	63
Gamble Township	603	0	0	0	18	0	0	18
Hepburn Township	1,467	1	44	0	96	0	9	150
Hughesville Borough	967	0	0	0	2	0	0	2
Jackson Township	331	0	1	1	10	0	1	13
Jersey Shore Borough	2,356	0	211	2	922	0	7	1,142
Jordan Township	565	0	1	0	10	0	0	11
Lewis Township	820	57	23	2	171	1	14	268

Table 4.3.3-7 **Structures in the SFHA by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Limestone Township	1,397	3	4	0	64	2	0	73
Loyalsock Township	5,344	4	83	2	182	0	1	272
Lycoming Township	966	3	102	1	203	0	12	321
McHenry Township	728	2	31	0	102	0	0	135
McIntyre Township	419	2	21	0	90	0	16	129
McNett Township	254	1	5	0	8	0	1	15
Mifflin Township	581	20	20	0	98	0	2	140
Mill Creek Township	313	0	1	0	8	0	0	9
Montgomery Borough	805	4	88	20	167	0	1	280
Montoursville Borough	2,257	1	32	1	36	0	4	74
Moreland Township	583	0	1	0	10	0	1	12
Muncy Borough	1,117	0	109	15	324	0	9	457
Muncy Creek Township	1,970	5	60	12	217	1	10	305
Muncy Township	655	0	3	0	10	0	1	14
Nippenose Township	558	8	4	0	55	0	1	68
Old Lycoming Township	3,091	2	67	16	331	1	11	428
Penn Township	573	0	4	1	23	0	1	29
Piatt Township	866	11	69	6	153	0	7	246
Picture Rocks Borough	300	0	2	3	4	0	1	10

Table 4.3.3-7 **Structures in the SFHA by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SFHA						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Pine Township	556	19	3	0	145	0	10	177
Plunketts Creek Township	711	8	3	0	93	0	22	126
Porter Township	870	4	10	2	142	0	1	159
Salladasburg Borough	145	0	16	1	15	0	0	32
Shrewsbury Township	298	0	7	0	63	0	3	73
South Williamsport Borough	2,899	7	16	0	81	0	5	109
Susquehanna Township	738	16	29	0	213	1	4	263
Upper Fairfield Township	915	1	4	0	51	0	11	67
Washington Township	1,298	1	1	0	97	0	0	99
Watson Township	511	1	14	0	136	0	3	154
Williamsport City	12,248	22	8	5	34	2	3	74
Wolf Township	1,551	1	17	0	42	0	12	72
Woodward Township	1,643	21	10	13	103	0	14	161
TOTAL	**63,791**	**271**	**1,234**	**121**	**5,150**	**12**	**227**	**7,015**

Mobile homes and commercial trailers are also particularly vulnerable to flooding due to their lightweight and unanchored design. Each municipalities' Floodplain Management Ordinance requires that manufactured homes be elevated and anchored to withstand flotation, collapse, and/or lateral movement. As discussed in Section 2.5, Lycoming County's structures database does not provide structure types. However, the County advised using a combination of the structures and parcel database, which does have property type, to identify the number and type of structures of mobile homes in Lycoming County and in the SFHA. Table 4.3.3-10 shows the number of structures on mobile home parcels in each municipality along with the number and proportion located in the SFHA. Notably, over 16% of all mobile homes in Lycoming County are floodprone.

Table 4.3.3-8 **Mobile homes per jurisdiction (Lycoming County GIS)**

MUNICIPALITY	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS IN MUNICIPALITY	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS IN SFHA	PERCENT STRUCTURES ON MOBILE HOME PARCELS IN SFHA
Anthony Township	22	1	0.0%
Armstrong Township	2	0	0.0%
Bastress Township	6	0	0.0%
Brady Township	19	0	0.0%
Brown Township	11	2	18.2%
Cascade Township	48	2	4.2%
Clinton Township	97	0	0.0%
Cogan House Township	58	1	0.0%
Cummings Township	43	33	76.7%
Duboistown Borough	5	0	0.0%
Eldred Township	25	0	0.0%
Fairfield Township	17	0	0.0%
Franklin Township	36	1	2.8%
Gamble Township	22	1	4.5%
Hepburn Township	38	5	13.2%
Hughesville Borough	0	0	0.0%
Jackson Township	17	0	0.0%
Jersey Shore Borough	21	4	19.0%
Jordan Township	60	0	0.0%
Lewis Township	50	15	30.0%
Limestone Township	53	8	15.1%
Loyalsock Township	18	3	16.7%

Table 4.3.3-8 **Mobile homes per jurisdiction (Lycoming County GIS)**

MUNICIPALITY	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS IN MUNICIPALITY	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS IN SFHA	PERCENT STRUCTURES ON MOBILE HOME PARCELS IN SFHA
Lycoming Township	76	29	38.2%
McHenry Township	60	13	0.0%
McIntyre Township	47	18	38.3%
McNett Township	23	0	0.0%
Mifflin Township	45	23	51.1%
Mill Creek Township	22	4	18.2%
Montgomery Borough	1	0	0.0%
Montoursville Borough	0	0	0.0%
Moreland Township	38	0	0.0%
Muncy Borough	1	1	100.0%
Muncy Township	18	17	94.4%
Muncy Creek Township	69	0	0.0%
Nippenose Township	16	1	6.3%
Old Lycoming Township	77	18	23.4%
Penn Township	32	1	3.1%
Piatt Township	48	21	43.8%
Picture Rocks Borough	1	0	0.0%
Pine Township	59	16	27.1%
Plunketts Creek Township	35	4	11.4%
Porter Township	54	8	14.8%
Salladasburg Borough	4	0	0.0%
Shrewsbury Township	17	2	11.8%
South Williamsport Borough	0	0	0.0%
Susquehanna Township	19	4	21.1%
Upper Fairfield Township	26	0	0.0%
Washington Township	89	6	6.7%
Watson Township	20	2	10.0%
Williamsport City	3	0	0.0%
Wolf Township	37	4	10.8%
Woodward Township	39	6	15.4%
TOTAL	**1,644**	**274**	**16.7%**

Flood events are also a major cause for 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.

4.3.4. Hailstorm

4.3.4.1. Location and Extent

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

4.3.4.2. Range of Magnitude

Hail is described qualitatively and quantitatively by its size and can range from 0.2 inches to 4.5 inches; the size of hail is dependent on the strength of the updraft, as shown in table 4.3.4-1. Lycoming County has experienced hail ranging in size from 0.15 to 3.00 inches in diameter.

Table 4.3.4-1 **Hailstone size and relationship to updraft speed (NOAA, 2013).**

HAILSTONE SIZE	MEASUREMENT (INCHES)	UPDRAFT SPEED (MPH)
BB	< 0.25	< 24
Pea	0.25	24
Marble	0.50	35
Dime	0.70	38
Penny	0.75	40
Nickel	0.88	46
Quarter	1.00	49
Half Dollar	1.25	54
Walnut	1.50	60
Golf Ball	1.75	64
Hen Egg	2.00	69
Tennis Ball	2.50	77
Baseball	2.75	81
Tea Cup	3.00	84
Grapefruit	4.00	98
Softball	4.50	103

Hailstorms can cause significant damage to crops, livestock and property. Damage is dependent on the size, duration, and intensity of hail precipitation. Those who do not seek shelter could face serious injury. Automobiles and aircraft are particularly susceptible to damage. Since hail precipitation usually occurs during thunderstorm events, the impacts of other hazards associated with thunderstorms (i.e. strong winds, intense precipitation, etc…) often occur simultaneously. Damage to trees, shrubbery, and other vegetation may occur during hailstorm events through defoliation. Unless there are compounding stresses, natural vegetation can typically recover over time following the event. However, crops such as corn and soybeans can be damaged to the point of total loss, particularly if an event occurs later in the growing season.

4.3.4.3. Past Occurrence

The NCDC reports 60 hail events in Lycoming County from 1956-2014 causing $350,000 in property damage, which can be seen in Table 4.3.4-2. As is typical, all of these events occurred from April to August, and most events occurred in the afternoon/early evening.

Table 4.3.4-2 **Lycoming County Hail Events 1956-2014 (NCDC, 2014).**

LOCATION	DATE	SIZE (IN)	INJURIES/ FATALITIES	PROPERTY LOSSES	CROP LOSSES
County-wide	6/23/1956	0.75 in.	0	0	0
County-wide	6/7/1964	1.00 in.	0	0	0
County-wide	6/17/1967	0.00 in.	0	0	0
County-wide	7/26/1969	1.75 in.	0	0	0
County-wide	6/18/1970	1.00 in.	0	0	0
County-wide	6/5/1973	0.88 in.	0	0	0
County-wide	7/28/1973	1.00 in.	0	0	0
County-wide	4/14/1974	3.00 in.	0	0	0
County-wide	4/14/1974	2.00 in.	0	0	0
County-wide	6/2/1978	1.00 in.	0	0	0
County-wide	7/11/1980	1.00 in.	0	0	0
County-wide	5/31/1985	1.75 in.	0	0	0
County-wide	5/31/1986	0.75 in.	0	0	0
County-wide	5/31/1986	1.00 in.	0	0	0
County-wide	5/31/1986	1.75 in.	0	0	0
County-wide	5/31/1986	1.75 in.	0	0	0
County-wide	4/25/1990	0.75 in.	0	0	0
County-wide	8/15/1991	0.75 in.	0	0	0
County-wide	8/15/1991	1.00 in.	0	0	0
County-wide	7/10/1992	1.00 in.	0	0	0
Danville	6/12/1994	0.75 in.	0	0	0
Williamsport	8/27/1994	1.00 in.	0	0	0
Warrensville	7/8/1996	0.85 in.	0	0	0
Williamsport	7/8/1996	0.15 in.	0	0	0
Picture Rocks	7/8/1996	0.75 in.	0	0	0
Hepburnville	7/7/1997	0.75 in.	0	0	0
Cedar Run	5/31/1998	1.00 in.	0	0	0
Buttonwood	5/31/1998	1.00 in.	0	0	0
Williamsport	9/7/1998	0.75 in.	0	0	0

Table 4.3.4-2 **Lycoming County Hail Events 1956-2014 (NCDC, 2014).**

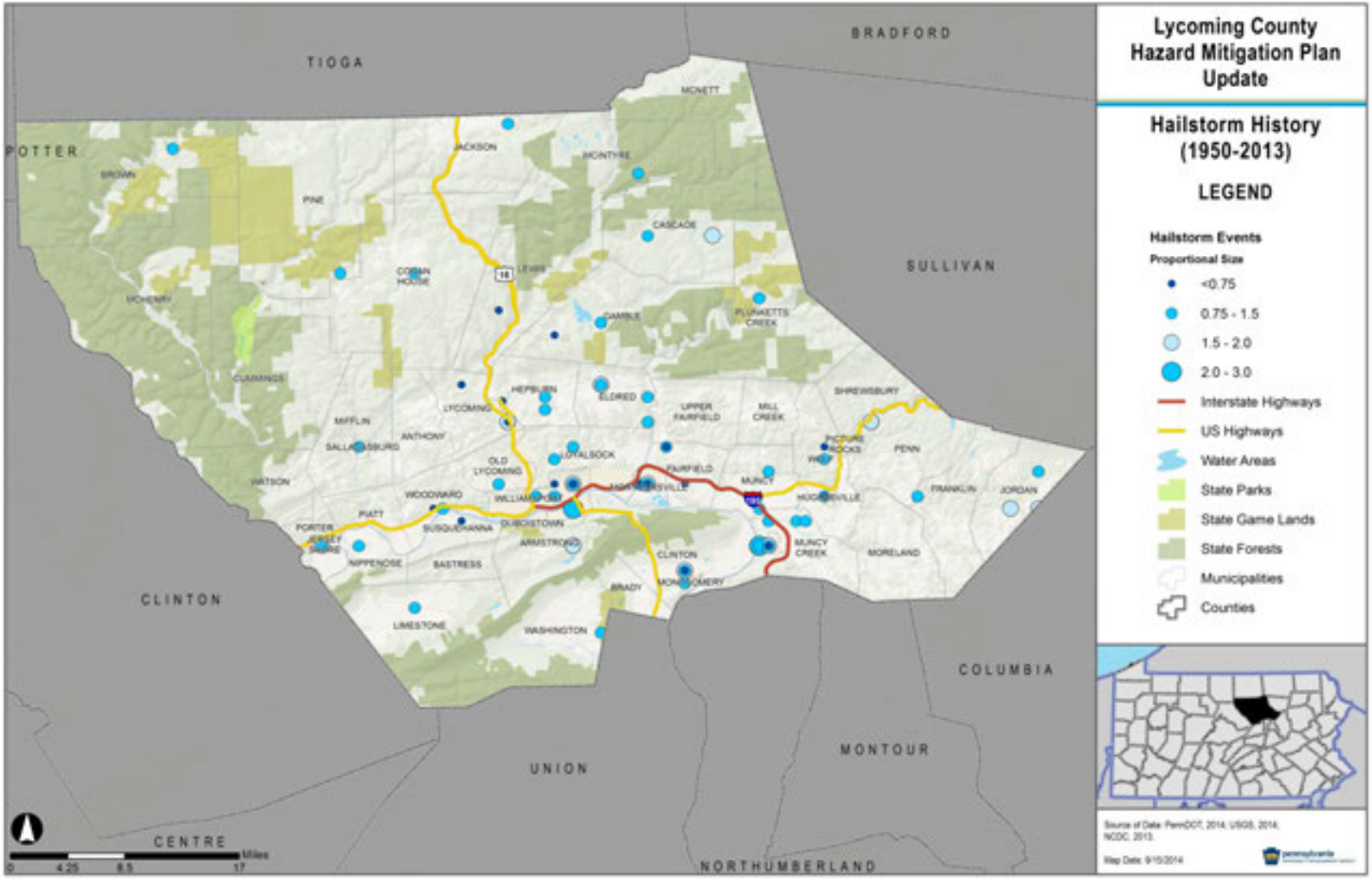
LOCATION	DATE	SIZE (IN)	INJURIES/ FATALITIES	PROPERTY LOSSES	CROP LOSSES
Muncy	9/7/1998	2.25 in.	0	0	0
Montgomery	5/8/1999	0.75 in.	0	0	0
Montoursville	7/30/1999	0.75 in.	0	0	0
Williamsport	7/30/1999	1.00 in.	0	0	0
Montgomery	7/30/1999	1.00 in.	0	0	0
Warrensville	7/30/1999	1.75 in.	0	0	0
Williamsport	7/30/1999	1.75 in.	0	0	0
Montgomery	7/30/1999	1.75 in.	0	0	0
Jersey Shore	7/30/1999	1.00 in.	0	0	500,000
Oval	7/30/1999	1.00 in.	0	0	0
Montgomery	3/25/2000	0.75 in.	0	0	0
Warrensville	5/10/2000	1.00 in.	0	0	0
Cogan House	5/12/2000	1.00 in.	0	0	0
Williamsport	5/12/2000	1.25 in.	0	0	0
Williamsport	7/11/2001	1.00 in.	0	0	0
Barbours	9/13/2001	1.00 in.	0	0	0
Hughesville	9/13/2001	1.00 in.	0	0	0
Williamsport	9/13/2001	0.75 in.	0	0	0
Unityville	9/13/2001	1.75 in.	0	0	0
Williamsport	6/5/2002	1.00 in.	0	0	0
Muncy	8/20/2004	0.88 in.	0	0	0
Montoursville	6/6/2005	1.00 in.	0	0	0
Williamsport	6/6/2005	1.00 in.	0	0	0
Montoursville	6/6/2005	0.75 in.	0	0	0
Williamsport	5/30/2006	0.75 in.	0	0	0
Williamsport	5/30/2006	1.00 in.	0	0	0
Williamsport	6/9/2006	0.88 in.	0	0	0
Montoursville	6/9/2006	0.88 in.	0	0	0
Quiggleville	7/9/2006	0.75 in.	0	0	0
Williamsport	7/9/2006	0.75 in.	0	0	0
Williamsport	8/3/2006	0.75 in.	0	0	0
Balls Mills	5/10/2007	1.00 in.	0	0	0
Hughesville	6/12/2007	1.00 in.	0	0	0
Lairdsville	6/13/2007	0.88 in.	0	0	0
Pennsdale	6/13/2007	0.88 in.	0	0	0
Williamsport	6/19/2007	0.75 in.	0	0	0
Muncy	6/19/2007	0.75 in.	0	0	0
Muncy	8/3/2007	0.88 in.	0	0	0
Garden View	8/17/2007	0.88 in.	0	0	0
Newberry	8/17/2007	1.00 in.	0	0	0
Loyalsockville	8/17/2007	0.88 in.	0	0	0
Montgomery	8/17/2007	1.50 in.	0	0	0
Muncy	8/17/2007	0.88 in.	0	0	0
Muncy	8/17/2007	1.75 in.	0	350,000	0
Trout Run	8/30/2007	0.75 in.	0	0	0
Balls Mills	9/27/2007	1.00 in.	0	0	0
Hughesville	2/6/2008	0.88 in.	0	0	0

Table 4.3.4-2 **Lycoming County Hail Events 1956-2014 (NCDC, 2014).**

LOCATION	DATE	SIZE (IN)	INJURIES/ FATALITIES	PROPERTY LOSSES	CROP LOSSES
Buttonwood	6/16/2008	0.88 in.	0	0	0
Salladasburg	6/16/2008	0.88 in.	0	0	0
Jersey Shore	6/16/2008	0.88 in.	0	0	0
Richards Grove	6/20/2008	0.88 in.	0	0	0
Pennsdale	7/26/2008	0.88 in.	0	0	0
(IPT) Williamsport Ar	7/11/2009	1.25 in.	0	0	0
Newberry	7/24/2009	0.88 in.	0	0	0
Muncy	7/24/2009	0.75 in.	0	0	0
Hepburnville	10/11/2010	0.75 in.	0	0	0
Williamsport	10/11/2010	1.00 in.	0	0	0
Leolyn	4/25/2011	0.88 in.	0	0	0
County-wide	6/9/2011	0.88 in.	0	0	0
County-wide	6/9/2011	0.88 in.	0	0	0
Tivoli	7/19/2011	1.75 in.	0	0	0
Jersey Shore	8/1/2011	1.00 in.	0	0	0
Linden	5/26/2012	0.88 in.	0	0	0
Hughesville	5/29/2012	0.88 in.	0	0	0
Newberry	7/7/2012	0.88 in.	0	0	0
Newberry	7/7/2012	1.00 in.	0	0	0
(IPT) Williamsport Ar	7/7/2012	0.75 in.	0	0	0
Hughesville	6/24/2013	0.75 in.	0	0	0
County-wide	9/11/2013	0.75 in.	0	0	0
County-wide	9/11/2013	1.00 in.	0	0	0
(IPT) Williamsport Ar	5/22/2014	0.88 in.	0	0	0
Muncy	5/22/2014	0.88 in.	0	0	0
Muncy	5/22/2014	1.00 in.	0	0	0
		TOTALS	**0**	**$350,000**	**$500,000**

Figure 4.3.4-1 maps the recorded hailstorm events in Lycoming County between 1950 and 2013.

Figure 4.3.4-1 **Number of hailstorm events in Lycoming County between 1950 and 2013 (NCDC, 2013).**



4.3.4.4. Future Occurrence

It is not possible to predict the formation of a hailstorm with more than a few days' lead time. The past occurrences in the County described above, however, indicate that this event is one that can happen several times in any given year, most likely during the late spring and summer months. Based on prior occurrences, the County can expect one to two recordable hailstorms each year. On the whole, though, the probability of future hail events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.4.5. Vulnerability Assessment

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

As a hazard, damage to crops and vehicles are typically the most significant impacts of hailstorms. The Pennsylvania Crop Insurance Education and Participation Program estimated that from 1981-2009, 6% of all crop losses in Pennsylvania were due to hail events (2010). Therefore, Lycoming County's $72.2 million in agricultural products are at risk in hail events. Corn and soybean crops are particularly vulnerable, and the USDA Census of Agriculture reports that in 2012, corn for grain, corn for silage, and soybeans were three of the top crop five crop items by acres (USDA, 2012).

4.3.5. Radon Exposure

4.3.5.1. Location and Extent

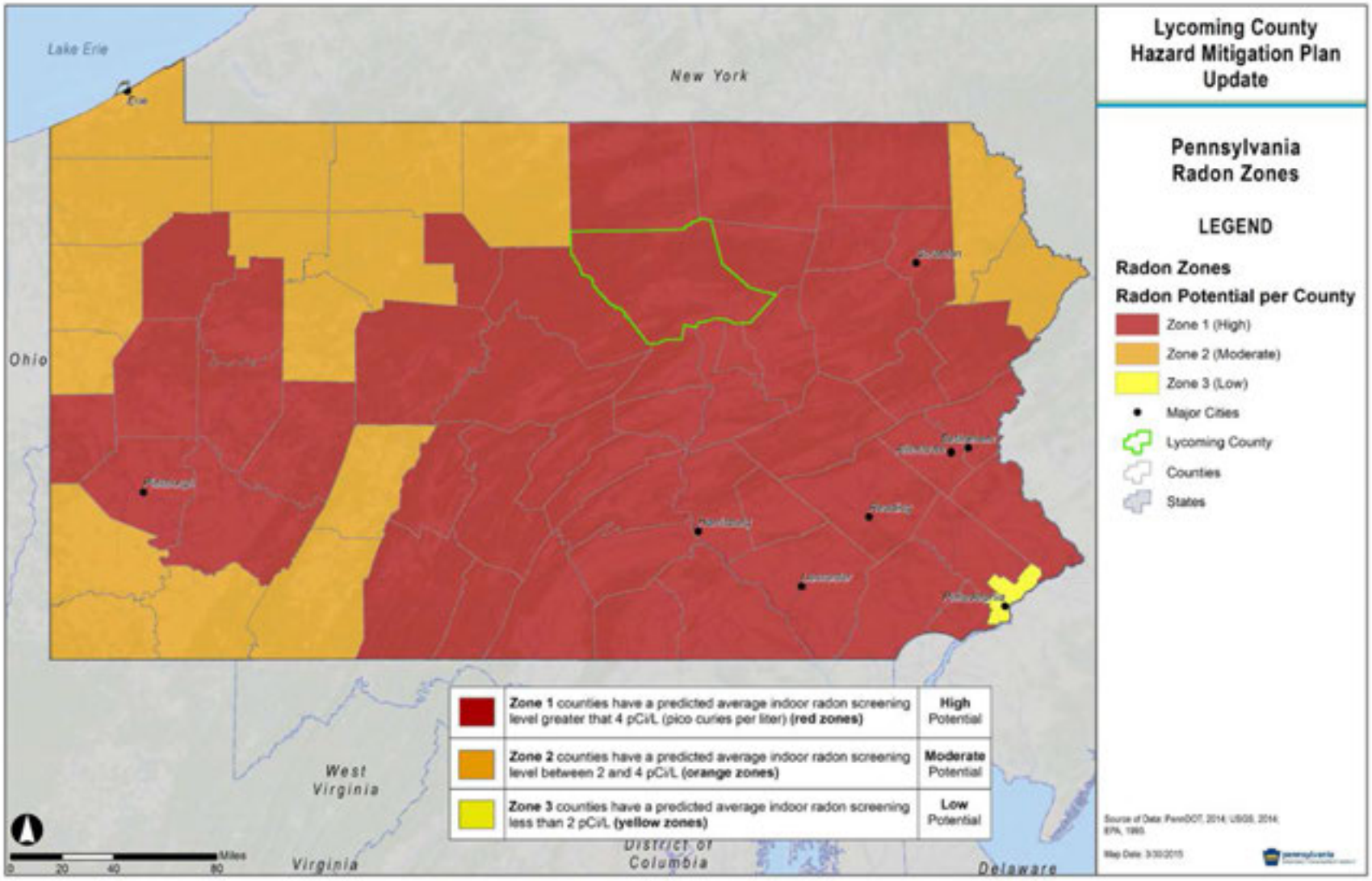
Radioactivity caused by airborne radon has been recognized for many years as an important component in the natural background radioactivity exposure of humans, but it was not until the 1980s that the wide geographic distribution of elevated values in houses and the possibility of extremely high radon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

Subsequent testing of the employee's home in the Reading Prong section of Pennsylvania showed extremely high radon levels around 2,500 pCi/L (pico Curies per Liter). To put this amount in perspective, the Environmental Protection Agency (EPA) guidelines state that actions should be taken if radon levels exceed 4 pCi/L in a home, and uranium miners have a maximum exposure of 67 pCi/L. As a result of this event, the Reading Prong became the focus of the first large-scale radon scare in the world.

Radon is a gas that cannot be seen or smelled. It is a noble gas that originates by the natural radioactive decay of uranium and thorium. Like other noble gases (e.g., helium, neon, and argon), radon forms essentially no chemical compounds and tends to exist as a gas or as a dissolved atomic constituent in groundwater. Two isotopes of radon are significant in nature, 222Rn and 220Rn, formed in the radioactive decay series of 238U and 232Th, respectively. The

isotope thoron (i.e. 220Rn) has a half-life (time for decay of half of a given group of atoms) of 55 seconds, barely long enough for it to migrate from its source to the air inside a house and pose a health risk. However, radon (i.e. 222Rn), which has a half-life of 3.8 days, is a widespread hazard. The distribution of radon is correlated with the distribution of radium (i.e. 226Ra), its immediate radioactive parent, and with uranium, its original ancestor. Due to the short half-life of radon, the distance that radon atoms can travel from their parent before decay is generally limited to distances of feet or tens of feet. Each county in Pennsylvania is classified as having a *low*, *moderate*, or *high* radon hazard potential. Lycoming County is classified as having a high hazard, meaning there is a predicted indoor radon level greater than 4 pCi/L (see Figure 4.3.5-1).

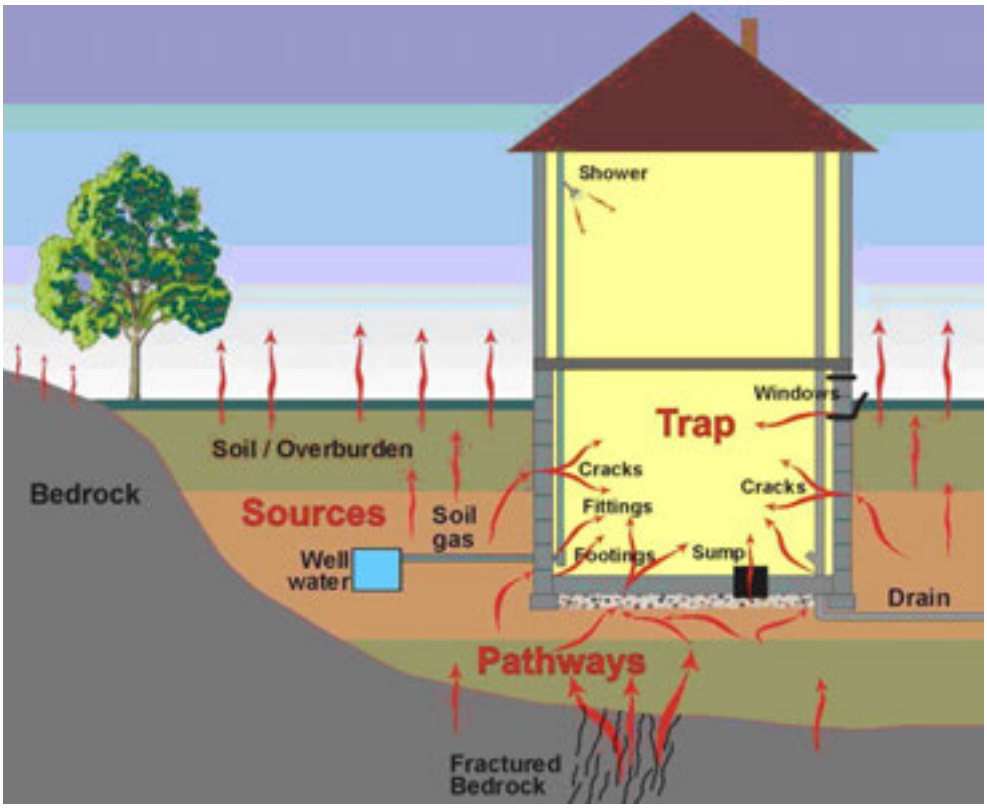
Figure 4.3.5-1 **Radon Hazard Zones in Pennsylvania (USEPA, 1993)**



Three sources of radon in houses are now recognized (shown in Figure 4.3.5-2):

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

Figure 4.3.5-2 **Sketch of radon entry points into a house (Arizona Geological Survey, 2006).**



High radon levels were initially thought to be exacerbated in houses that are tightly sealed, but it is now recognized that rates of air flow into and out of houses, plus the location of air inflow and the radon content of air in the surrounding soil, are key factors in radon concentrations. Outflows of air from a house, caused by a furnace, fan, thermal “chimney” effect, or wind effects, require that air be drawn into the house to compensate. If the upper part of the house is tight enough to impede influx of outdoor air (radon concentration generally <0.1 pCi/L), then an appreciable fraction of the air may be drawn in from the soil or fractured bedrock through the foundation and slab beneath the house, or through cracks and openings for pipes, sumps, and similar features (see Figure 4.3.4-2). Soil gas typically contains from a few hundred to a few thousand pCi/L of radon; therefore, even a small rate of soil gas inflow can lead to elevated radon concentrations in a house.

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

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

- Areas of very elevated uranium content (>50 ppm) around uranium deposits and prospects. Although very high levels of radon can occur in such areas, the hazard normally is restricted to within a few hundred feet of the deposit. In Pennsylvania, such localities occupy an insignificant area.
- Areas of common rocks having higher than average uranium content (5 to 50 ppm). In Pennsylvania, such rock types include granitic and felsic alkali igneous rocks and black shales. In the Reading Prong, high uranium values in rock or soil and high radon levels in houses are associated with Precambrian granitic gneisses commonly containing 10 to 20 ppm uranium, but locally containing more than 500 ppm uranium. In Pennsylvania, elevated uranium occurs in black shales of the Devonian Marcellus Formation and possibly the Ordovician Martinsburg Formation. High radon values are locally present in areas underlain by these formations.
- Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses. This group is incompletely understood at present. Relatively high soil permeability can lead to high radon, the clearest example being houses built on glacial eskers. Limestone-dolomite soils also appear to be predisposed for high radon levels in houses, perhaps because of the deep clay-rich residuum in which radium is concentrated by weathering on iron oxide or clay surfaces, coupled with moderate porosity and permeability. The importance of carbonate soils is indicated by the fact that radon contents in 93 percent of a sample of houses built on limestone-dolomite soils near State College, Centre County, exceeded 4 pCi/L, and 21 percent exceeded 20 pCi/L, even though the uranium values in the underlying bedrock are all in the normal range of 0.5 to 5 ppm uranium.

The second factor listed above is most likely the cause of high radon levels in Lycoming County. There are eight areas of Lycoming County which have had high radon level test results, mostly in the central area of the County. The areas and test results are shown in more detail in Table 4.3.5-2.

4.3.5.2. Range of Magnitude

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

Table 4.3.5-1 **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 the risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
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.*

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 4.3.4-1 shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As is shown in Table 4.3.4-1, a smoker exposed to radon has a much higher risk of lung cancer.

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

4.3.5.3. Past Occurrence

Current data on abundance and distribution of radon as it affects individual houses in Pennsylvania in general and Lycoming County specifically is considered incomplete and potentially biased. The EPA has estimated that the national average indoor radon concentration is 1.3 pCi/L and the level for action is 4.0 pCi/L; however they have estimated that the average indoor concentration in Pennsylvania basements is about 7.1 pCi/L and 3.6 pCi/L on the first floor (PADEP, 2011).

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 is reported to the Bureau 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 Lycoming County eight zip codes had sufficient tests reported to the Bureau to report their findings, which are shown in Table 4.3.5-2. The spatial distribution of this data is illustrated in Figures 4.3.5-3 and 4.3.5-4.

Table 4.3.5-2 **Radon level tests and results in Lycoming County zip codes (PADEP, 2015).**

ZIP CODE	AREA OF LYCOMING COUNTY	LOCATION OF TEST	NUMBER OF TESTS	MAXIMUM RESULT (pCi/L)	AVERAGE RESULT (pCi/L)
17701	Williamsport	Basement	1849	834	10.4
17701	Williamsport	First Floor	315	143.5	4.7
17754	Montoursville	Basement	835	238.2	10.9
17754	Montoursville	First Floor	76	39.4	6.7
17728	Cogan Station	Basement	235	359.7	17.1
17728	Cogan Station	First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17702	Williamsport	Basement	241	170	7.4

Table 4.3.5-2 **Radon level tests and results in Lycoming County zip codes (PADEP, 2015).**

ZIP CODE	AREA OF LYCOMING COUNTY	LOCATION OF TEST	NUMBER OF TESTS	MAXIMUM RESULT (pCi/L)	AVERAGE RESULT (pCi/L)
17702	Williamsport	First Floor	51	37.5	4.3
17737	Hughesville	Basement	174	322	12.9
17737	Hughesville	First Floor	33	9.4	2.5
17752	Montgomery	Basement	96	75.7	6.2
17752	Montgomery	First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17771	Trout Run	Basement	67	159	20.8
17771	Trout Run	First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17744	Linden	Basement	53	187	20
17744	Linden	First Floor	Insufficient Data	Insufficient Data	Insufficient Data

Figure 4.3.5-3 **Pennsylvania Average Basement Radon Test Results from 1990-2010 (PADEP, 2013)**

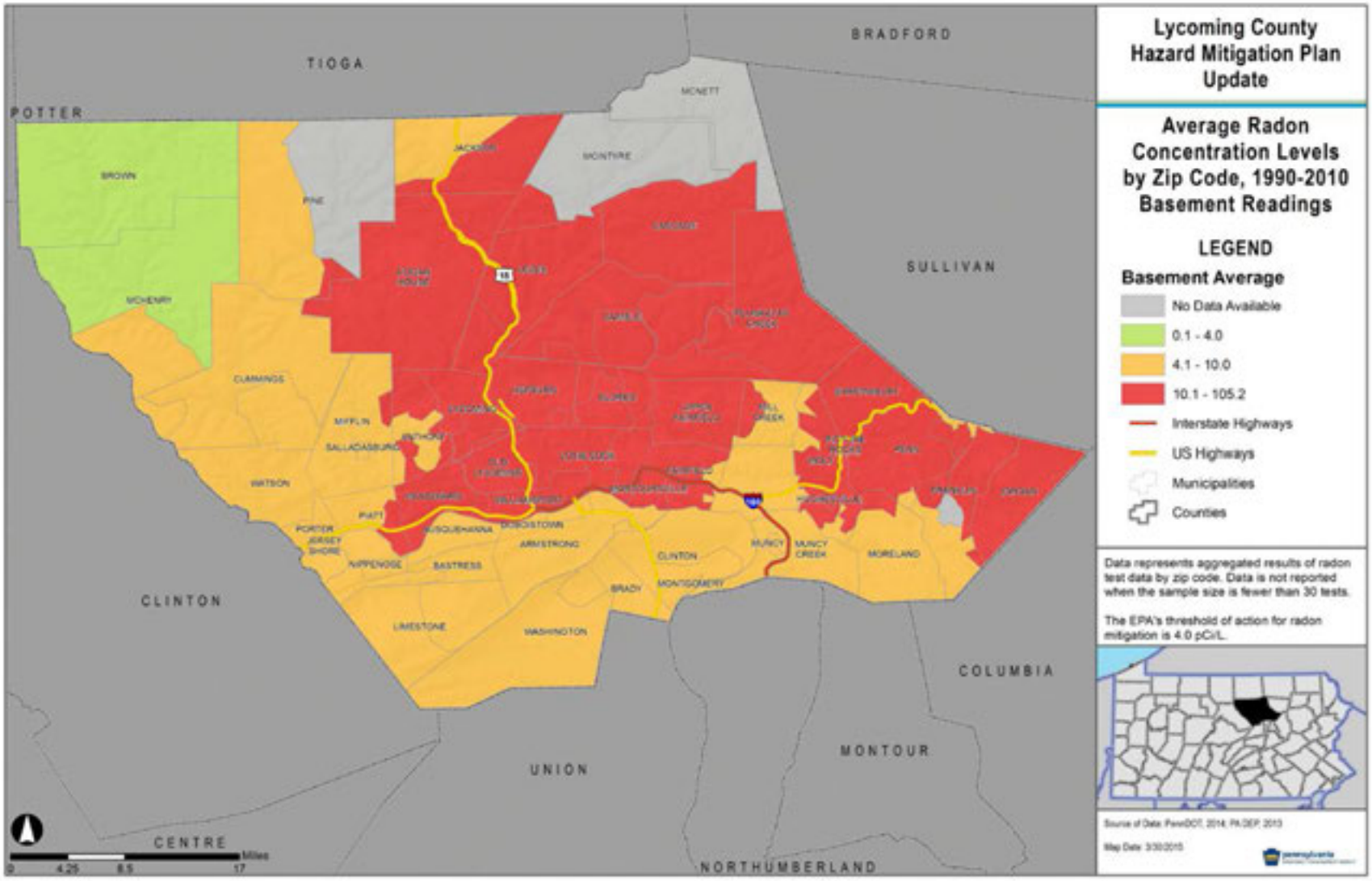
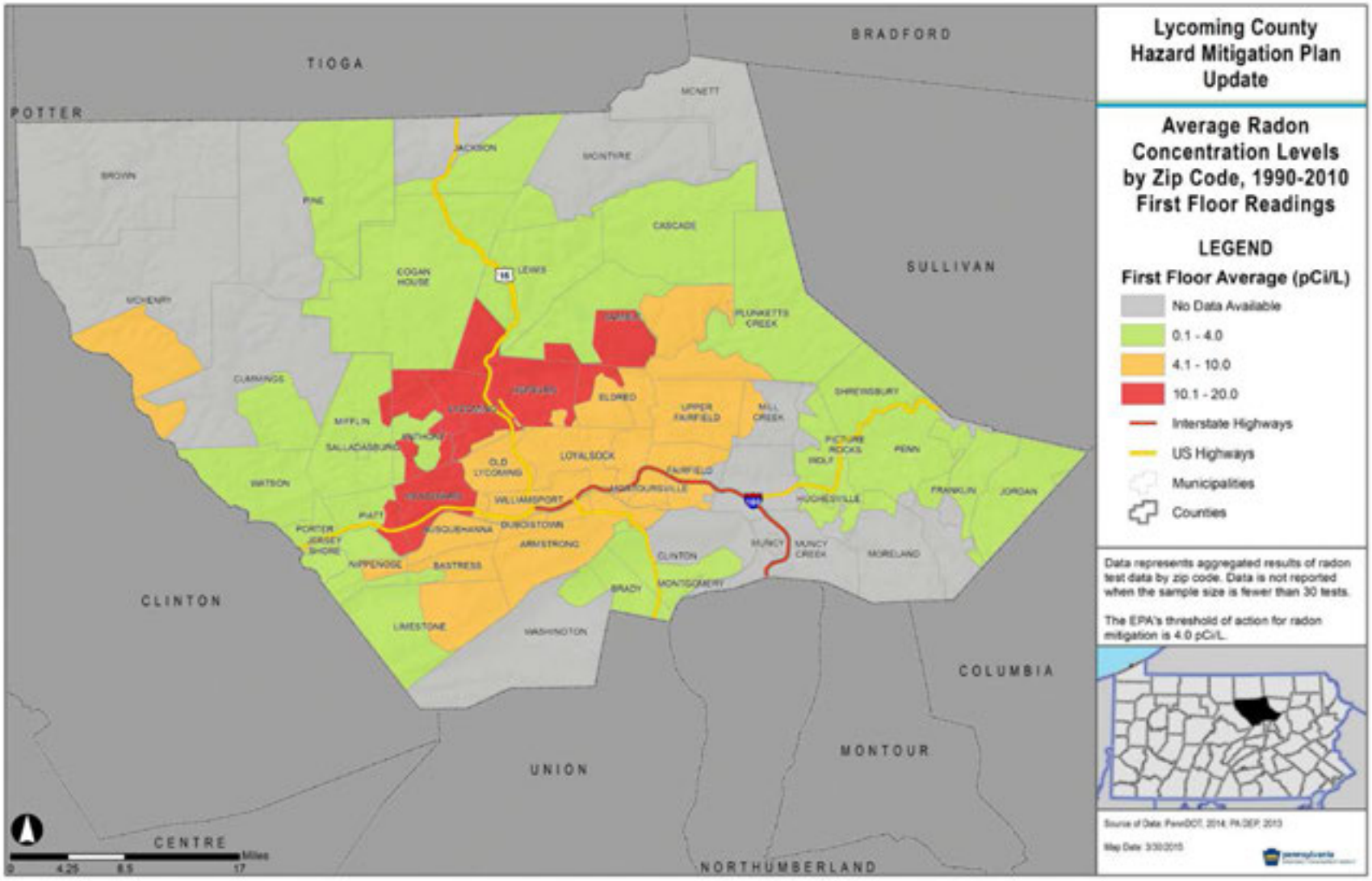


Figure 4.3.5-4 **Pennsylvania Average First Floor Radon Test Results from 1990-2010 (PADEP, 2013)**



4.3.5.4. Future Occurrence

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

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

4.3.5.5. Vulnerability Assessment

As Table 4.3.5-2 shows, houses in Lycoming County, especially in the central areas of the County, could be susceptible to high levels of radon. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to (see Table 4.3.5-1). Older houses that have crawl spaces or unfinished basements are more vulnerable as well because of the increased exposure to soils which could be releasing higher levels of radon gas. Additionally, houses that rely on wells for their water may face an additional risk, although this type of exposure is low and rare in Pennsylvania.

Proper testing for radon levels should be completed across Lycoming County, especially in the areas of higher incidence levels and for those individuals and households that face the contributing risks described above. This testing will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools. The Pennsylvania Department of Environmental Protection Bureau of Radiation Protection provides short and long term tests to determine radon levels as well as information on how to mitigate high levels of radon in a building. According to the EPA repairs to houses to protect against radon can cost on average the same as regular house repairs (EPA, October 2010). As seen in Figures 4.3.5-3 and 4.3.5-4, areas with the highest reported tests were primarily located in the central and northeastern portions of the County.

4.3.6. Subsidence, Sinkhole

4.3.6.1. Location and Extent

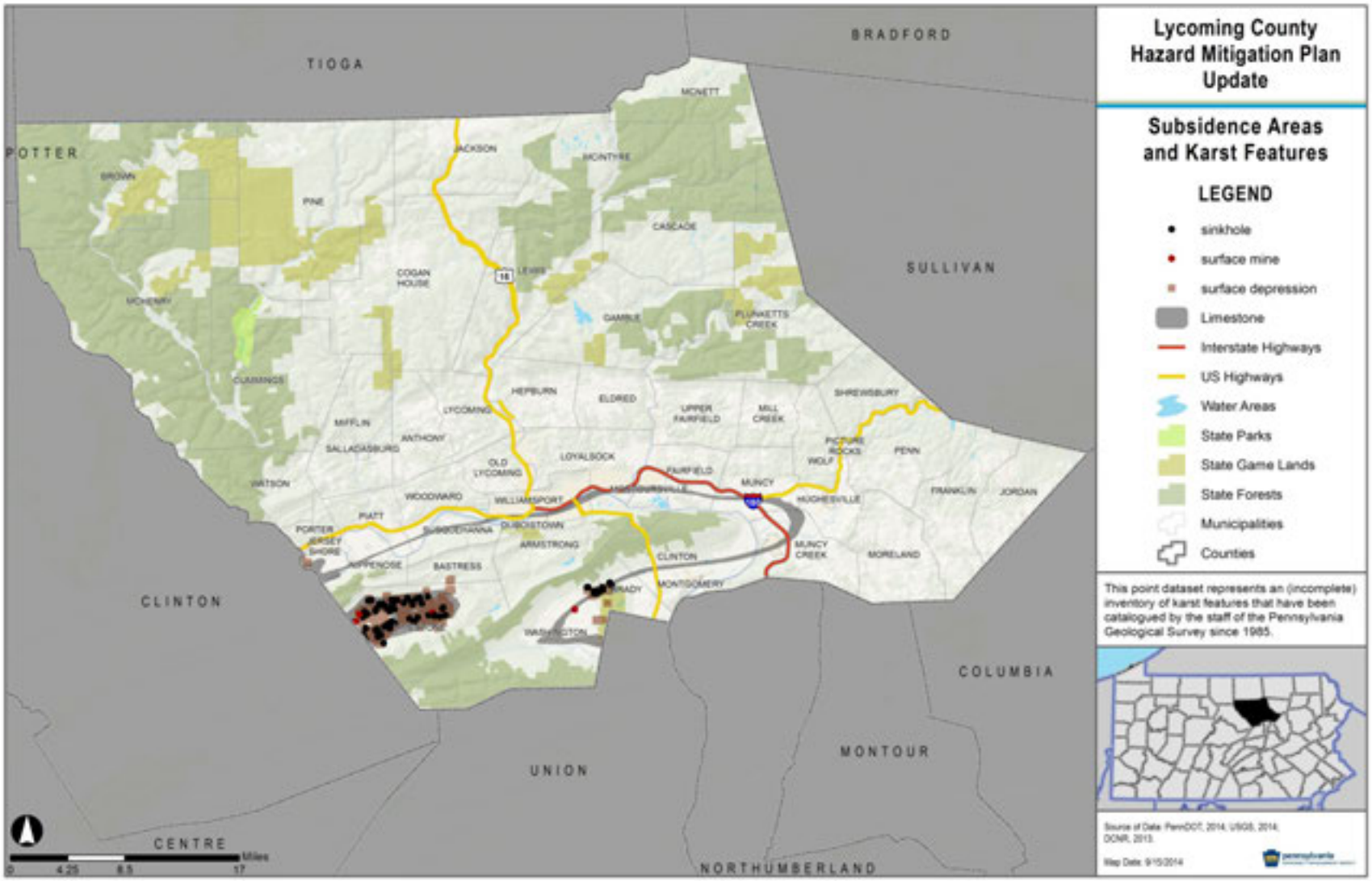
Subsidence potential in Lycoming County is primarily associated with the solution of carbonate bedrock, such as limestone and dolomite, by water. Water passing through naturally occurring fractures and bedding planes dissolves the bedrock, leaving voids below the surface (DCNR, 2009). Eventually, overburden on top of the voids 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 (e.g. water). Figure 4.3.6-1 shows that a small portion of Lycoming 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 illustrates DCNR's

partial inventory of sinkholes and surface depressions. The following municipalities have identified near-surface limestone and are therefore vulnerable to sinkholes:

- Armstrong Township
- Brady Township
- Clinton Township
- Duboistown Borough
- Fairfield Township
- Limestone Township
- Montoursville Borough
- Muncy Borough
- Muncy Creek Township
- Muncy Township
- Nippenose Township
- Piatt Township
- Porter Township
- South Williamsport Borough
- Susquehanna Township
- Washington Township
- Williamsport, City of
- Wolf Township
- Woodward Township

Human activity 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.

Figure 4.3.6-1 **Map showing areas of Lycoming County subject to natural subsidence due to the presence of limestone bedrock. Inventoried surface depression and sinkhole locations are also shown.**



4.3.6.2. 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 Lycoming 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 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.

Figure 4.3.6-2 **Sinkhole at Corporate Plaza Building in Allentown, Lehigh County, PA in February 1994 (Photography by William E. Kochanov – DCNR, 2009)**

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 of concern.

The worst case scenario for sinkholes in Lycoming County would be a series of large sinkholes opening in Muncy Township. Though the geographic minority of the township is vulnerable to sinkholes, a series of sinkholes in this township could cut off access to I-180 and US-220, both major roads in the County. In addition, Muncy Township has the highest value of property within the vulnerable area: over $264 million. In addition, this series of sinkholes could close secondary roads, cause power outages, prevent the delivery of emergency services, and cause injuries or death to the township's residents.

4.3.6.3. Past Occurrence

According to the Pennsylvania Department of Conservation and Natural Resources (DCNR) there have been a total of 70 sinkholes and 391 surface depressions in Lycoming County as of 2014. Table 4.3.6-1 shows the breakdown of sinkhole and surface depression by municipality.

Table 4.3.6-1 **Sinkhole and surface depressions in Lycoming County by municipality (DCNR 2014).**

MUNICIPALITY	SINKHOLE	SURFACE DEPRESSION
Brady Township	3	3
Bastress Township	0	4
Limestone Township	56	360
Porter Township	0	3
Washington Township	11	21
TOTAL	**70**	**391**

4.3.6.4. Future Occurrence

Based on geological conditions, subsidence events may possibly occur in the future for the areas of Lycoming County underlain by carbonate rock such as limestone. Sinkholes and surface depressions are dependent on a number of variables, including land use and water management. Changes in these variables can affect the likelihood and frequency of future subsidence events. On the whole, though, the probability of future subsidence and sinkhole events can be considered *unlikely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.6.5. Vulnerability Assessment

The following municipalities have identified near-surface limestone, and are therefore vulnerable to sinkholes:

- Armstrong Township
- Brady Township
- Clinton Township
- Duboistown Borough
- Fairfield Township
- Limestone Township
- Loyalsock Township
- Montoursville Borough
- Muncy Borough
- Muncy Creek Township
- Muncy Township
- Nippenose Township
- Piatt Township
- Porter Township
- South Williamsport Borough
- Susquehanna Township
- Washington Township
- City of Williamsport
- Wolf Township
- Woodward Township

The secondary effects of sinkhole formation have the potential to cause significant impacts in communities underlain by surface-level limestone, including structural damage, damage to transportation systems, and damage to subsurface utility systems. Structures and critical facilities located over limestone and dolomite bedrock are considered vulnerable to sinkholes and are inventoried in Table 4.3.6-2. Most vulnerable structures and critical facilities are located in Limestone Township. Table 4.3.6-3 provides the property type of the vulnerable structures within subsidence areas in Lycoming County.

Table 4.3.6-2 **Subsidence vulnerability for Lycoming County.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SUBSIDENCE-PRONE AREAS	PERCENT OF STRUCTURES IN SUBSIDENCE-PRONE AREAS	TOTAL CRITICAL FACILITIES	TOTAL CRITICAL FACILITIES IN SUBSIDENCE-PRONE AREAS	PERCENT CRITICAL FACILITIES IN SUBSIDENCE-PRONE AREAS
Anthony Township	389	0	0.0%	6	0	0.0%
Armstrong Township	533	8	1.5%	2	0	0.0%
Bastress Township	253	0	0.0%	4	0	0.0%
Brady Township	351	42	12.0%	3	0	0.0%
Brown Township	428	0	0.0%	4	0	0.0%
Cascade Township	351	0	0.0%	4	0	0.0%
Clinton Township	1,536	113	7.4%	21	0	0.0%
Cogan House Township	1,044	0	0.0%	11	0	0.0%
Cummings Township	843	0	0.0%	4	0	0.0%
Duboistown Borough	733	186	25.4%	8	3	37.5%
Eldred Township	968	0	0.0%	5	0	0.0%
Fairfield Township	1,484	261	17.6%	12	4	33.3%
Franklin Township	609	0	0.0%	10	0	0.0%
Gamble Township	603	0	0.0%	4	0	0.0%
Hepburn Township	1,467	0	0.0%	12	0	0.0%
Hughesville Borough	967	0	0.0%	21	0	0.0%
Jackson Township	331	0	0.0%	2	0	0.0%
Jersey Shore Borough	2,356	0	0.0%	39	0	0.0%
Jordan Township	565	0	0.0%	8	0	0.0%
Lewis Township	820	0	0.0%	7	0	0.0%
Limestone Township	1,397	890	63.7%	14	10	71.4%
Loyalsock Township	5,344	57	1.1%	54	2	3.7%
Lycoming Township	966	0	0.0%	6	0	0.0%
McHenry Township	728	0	0.0%	5	0	0.0%

Table 4.3.6-2 **Subsidence vulnerability for Lycoming County.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SUBSIDENCE-PRONE AREAS	PERCENT OF STRUCTURES IN SUBSIDENCE-PRONE AREAS	TOTAL CRITICAL FACILITIES	TOTAL CRITICAL FACILITIES IN SUBSIDENCE-PRONE AREAS	PERCENT CRITICAL FACILITIES IN SUBSIDENCE-PRONE AREAS
McIntyre Township	419	0	0.0%	8	0	0.0%
McNett Township	254	0	0.0%	2	0	0.0%
Mifflin Township	581	0	0.0%	6	0	0.0%
Mill Creek Township	313	0	0.0%	4	0	0.0%
Montgomery Borough	805	0	0.0%	14	0	0.0%
Montoursville Borough	2,257	459	20.3%	32	4	12.5%
Moreland Township	583	0	0.0%	7	0	0.0%
Muncy Borough	1,117	267	23.9%	17	7	41.2%
Muncy Creek Township	1,970	299	15.2%	21	4	19.0%
Muncy Township	655	75	11.5%	14	1	7.1%
Nippenose Township	558	106	19.0%	7	1	14.3%
Old Lycoming Township	3,091	0	0.0%	22	0	0.0%
Penn Township	573	0	0.0%	2	0	0.0%
Piatt Township	866	25	2.9%	5	0	0.0%
Picture Rocks Borough	300	0	0.0%	9	0	0.0%
Pine Township	556	0	0.0%	3	0	0.0%
Plunketts Creek Township	711	0	0.0%	7	0	0.0%
Porter Township	870	31	3.6%	7	0	0.0%
Salladasburg Borough	145	0	0.0%	2	0	0.0%
Shrewsbury Township	298	0	0.0%	2	0	0.0%
South Williamsport Borough	2,899	360	12.4%	28	1	3.6%
Susquehanna Township	738	154	20.9%	6	4	66.7%
Upper Fairfield Township	915	0	0.0%	14	0	0.0%
Washington Township	1,298	297	22.9%	11	9	81.8%
Watson Township	511	0	0.0%	1	0	0.0%
Williamsport City	12,248	75	0.6%	129	6	4.7%
Wolf Township	1,551	0	0.0%	15	0	0.0%
Woodward Township	1,643	8	0.5%	14	0	0.0%
TOTAL	**63,791**	**3,713**	**5.8%**	**675**	**56**	**8.3%**

Table 4.3.6-3 **Structures in subsidence-prone areas by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SUBSIDENCE-PRONE AREAS						
		CIVIC/ INSTITUTIONAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Anthony Township	389	0	0	0	0	0	0	0
Armstrong Township	533	2	0	2	4	0	0	8
Bastress Township	253	0	0	0	0	0	0	0
Brady Township	351	0	1	0	40	0	1	42
Brown Township	428	0	0	0	0	0	0	0
Cascade Township	351	0	0	0	0	0	0	0
Clinton Township	1,536	7	4	0	101	0	1	113
Cogan House Township	1,044	0	0	0	0	0	0	0
Cummings Township	843	0	0	0	0	0	0	0
Duboistown Borough	733	0	13	0	173	0	0	186
Eldred Township	968	0	0	0	0	0	0	0
Fairfield Township	1,484	2	155	1	100	2	1	261
Franklin Township	609	0	0	0	0	0	0	0
Gamble Township	603	0	0	0	0	0	0	0
Hepburn Township	1,467	0	0	0	0	0	0	0
Hughesville Borough	967	0	0	0	0	0	0	0
Jackson Township	331	0	0	0	0	0	0	0
Jersey Shore Borough	2,356	0	0	0	0	0	0	0
Jordan Township	565	0	0	0	0	0	0	0
Lewis Township	820	0	0	0	0	0	0	0

Table 4.3.6-3 **Structures in subsidence-prone areas by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SUBSIDENCE-PRONE AREAS						
		CIVIC/ INSTITUTIONAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Limestone Township	1,397	18	18	12	805	2	35	890
Loyalsock Township	5,344	0	39	3	14	0	1	57
Lycoming Township	966	0	0	0	0	0	0	0
McHenry Township	728	0	0	0	0	0	0	0
McIntyre Township	419	0	0	0	0	0	0	0
McNett Township	254	0	0	0	0	0	0	0
Mifflin Township	581	0	0	0	0	0	0	0
Mill Creek Township	313	0	0	0	0	0	0	0
Montgomery Borough	805	0	0	0	0	0	0	0
Montoursville Borough	2,257	0	116	17	324	1	1	459
Moreland Township	583	0	0	0	0	0	0	0
Muncy Borough	1,117	0	12	8	244	0	3	267
Muncy Creek Township	1,970	0	57	3	231	1	7	299
Muncy Township	655	2	18	2	52	0	1	75
Nippenose Township	558	0	41	0	65	0	0	106
Old Lycoming Township	3,091	0	0	0	0	0	0	0
Penn Township	573	0	0	0	0	0	0	0
Piatt Township	866	0	0	0	25	0	0	25
Picture Rocks Borough	300	0	0	0	0	0	0	0

Table 4.3.6-3 **Structures in subsidence-prone areas by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN SUBSIDENCE-PRONE AREAS						
		CIVIC/ INSTITUTIONAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Pine Township	556	0	0	0	0	0	0	0
Plunketts Creek Township	711	0	0	0	0	0	0	0
Porter Township	870	1	0	0	30	0	0	31
Salladasburg Borough	145	0	0	0	0	0	0	0
Shrewsbury Township	298	0	0	0	0	0	0	0
South Williamsport Borough	2,899	0	97	15	235	3	10	360
Susquehanna Township	738	2	14	0	135	0	3	154
Upper Fairfield Township	915	0	0	0	0	0	0	0
Washington Township	1,298	8	12	0	276	1	0	297
Watson Township	511	0	0	0	0	0	0	0
Williamsport City	12,248	8	32	13	19	1	2	75
Wolf Township	1,551	0	0	0	0	0	0	0
Woodward Township	1,643	1	1	0	6	0	0	8
TOTAL	**63,791**	**51**	**630**	**76**	**2,879**	**11**	**66**	**3,713**

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, conduct selective support 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.

Careful planning is the least-costly and most effective method for reducing vulnerability to subsidence hazards. 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.

4.3.7. Tornado, Windstorm

4.3.7.1. Location and Extent

Tornadoes and windstorms can affect any area of the County. Straight-line winds create movement of air from areas of higher pressure to areas of lower pressure – the greater the difference in pressure, the stronger the winds. Windstorms are generally defined as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.

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

The enhanced Fujita Tornado Scale (or the -EF-Scale‖) classifies U.S. tornadoes into six intensity categories, named EF0 to EF5, based upon the estimated maximum winds occurring within the funnel. The EF-Scale has subsequently become the definitive metric for estimating wind speeds within tornadoes based upon the damage done to buildings and structures.

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. Tornado movement is characterized in two ways: direction and speed of the spinning winds, and forward movement of the tornado/storm track. Rotational wind speeds of the vortex can range from 100 mph to more than 250 mph. In addition, the speed of forward motion can be zero to 45 or 50 mph. Therefore, some estimates place the maximum velocity (combination of ground speed, wind speed, and upper winds) of tornadoes at about 300 mph.

The forward motion of the tornado path can be a few hundred yards or several hundred miles in length. The width of tornadoes can vary greatly, but generally range in size from less than 100

feet to over a mile in width. Some tornadoes never touch the ground and are short-lived, while others may touch the ground several times.

Tornadoes have occurred in every state, but they frequently occur in the Midwest, southeast, and southwest. Although tornado season runs from March through August, tornadoes can occur any time, often accompanying tropical storms and hurricanes as they move onto land. The National Weather Service estimates that about 43 people are killed because of tornadoes each year. Areas in the Commonwealth most prone to tornadoes and windstorms are the southeast, southwest, and northwest sectors. Tornado events are not limited to any particular geographic or physiographic area of the County, and neither the duration of the storm nor the extent of area affected by such an occurrence can be predicted.

High winds and tornadoes can affect any area of the County. Figure 4.3.7-2 shows tornadoes that have affected (touch-downed or passed through) the County.

4.3.7.2. Range of Magnitude

Each year, tornadoes account for $1.1 billion in damages and cause over 80 deaths nationally (NCAR, 2001). 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 and windstorms move through populated, developed areas. Windstorms are generally defined as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration. The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as mobile homes. The 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,” which was published in 1971. The EF-Scale provides engineered wind estimates and better damage descriptions. It classifies United States tornadoes into six intensity categories, as shown in Table 4.3.7-1, 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 also provided since previous tornado occurrences are described based on the F-Scale.

As shown in the following map, Lycoming County can expect winds up to 200 miles per hour, and should implement construction regulations requiring that structures be designed to withstand winds of that magnitude.

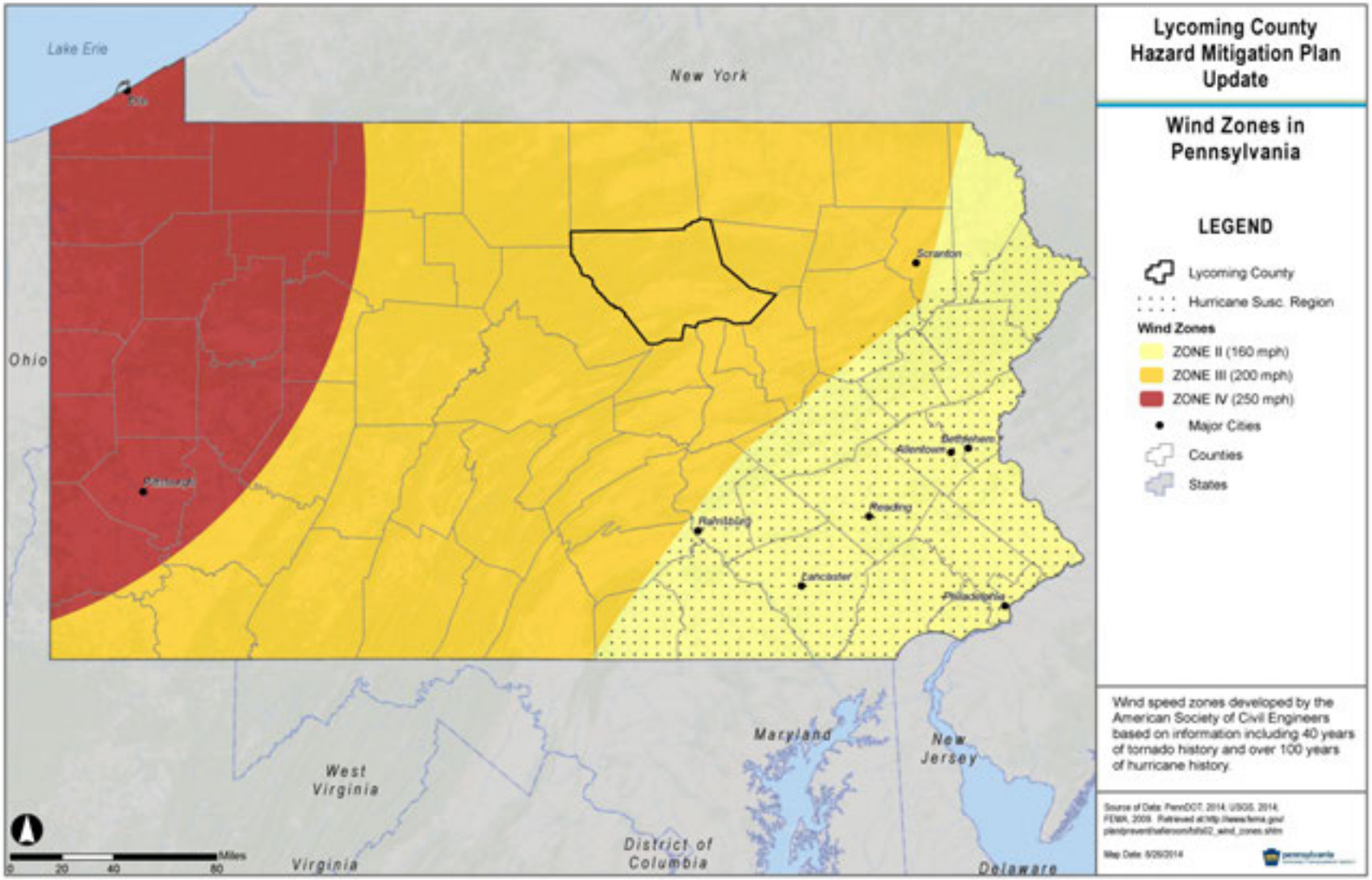
Table 4.3.7-1 **Enhanced Fujita Scale (EF-Scale) categories with associated wind speeds and description of damages.**

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

Since tornado and windstorm events are typically localized, environmental impacts of these events 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 4.3.7-1 in order to prevent release of hazardous materials into the environment.

In May 1998, a tornado swept through Lycoming County, touching down in Mifflin Township, Wolf Township, the Williamsport Regional Airport, and Jackson Township, where it tore the roof off a lumberyard, downed power lines, and destroyed trees in the Village of Buttonwood. At the airport, $1 million in structural and airplane damages was reported. In the City of Williamsport, downed trees, malfunctioning traffic signals, debris-filled streets, snapped power lines, and

Figure 4.3.7-1 **Map showing wind zones to guide design standards and shelter construction.**



vehicular and property damage was observed. In Muncy, damage to street signs and billboards was observed. In Hughesville, a tornado destroyed one residential trailer and blew another off its foundation. While no immediate reports of injuries were made, a tornado poses a significant life safety threat to the community, particularly while traveling in vehicles or sheltering in a poorly constructed building.

4.3.7.3. Past Occurrence

Historically, between 1950 and 2011, there were 26 tornadoes in Lycoming County. According to the National Oceanic Atmospheric Administration (NOAA), there were two deaths and 20 injuries in Lycoming County resulting from a tornado on May 31, 1985, and no deaths or injuries since. Additionally, associated winds have damaged power lines, uprooting trees, structures, motor vehicles, and crops.

In the past 40 years, several tornadoes have swept through Lycoming County: Susquehanna Township (1976), Washington Township (1985), Shrewsbury Township (1985), Hughesville Borough (1994), and the Village of Loyalsockville (1996). “A series of tornadoes in May 1985 caused the president to declare 13 northwestern and central Pennsylvania counties major disaster areas. Damages were estimated at $282 million.” In May 1998, a tornado swept through Lycoming County, touching down in Mifflin Township, Wolf Township, the Williamsport Regional Airport, and Jackson Township, where it tore the roof off a lumberyard, downed power lines, and destroyed trees in the Village of Buttonwood. The following June, there were two confirmed tornadoes in the forested area near the Borough of Picture Rocks. On July 1, 1999, a tornado touched down in Kellyburg, and on June 16, 2000, another tornado did some minor damage to homes and uprooted several trees in the Village of Farragut.

As can be seen from the Table 4.3.7-2, the magnitude of reported and confirmed tornadoes in the County over the last five years is in the F0 to F1 range. While this is the lowest range to be classified as a tornado, such events can nevertheless be devastating to human life and property in the affected areas.

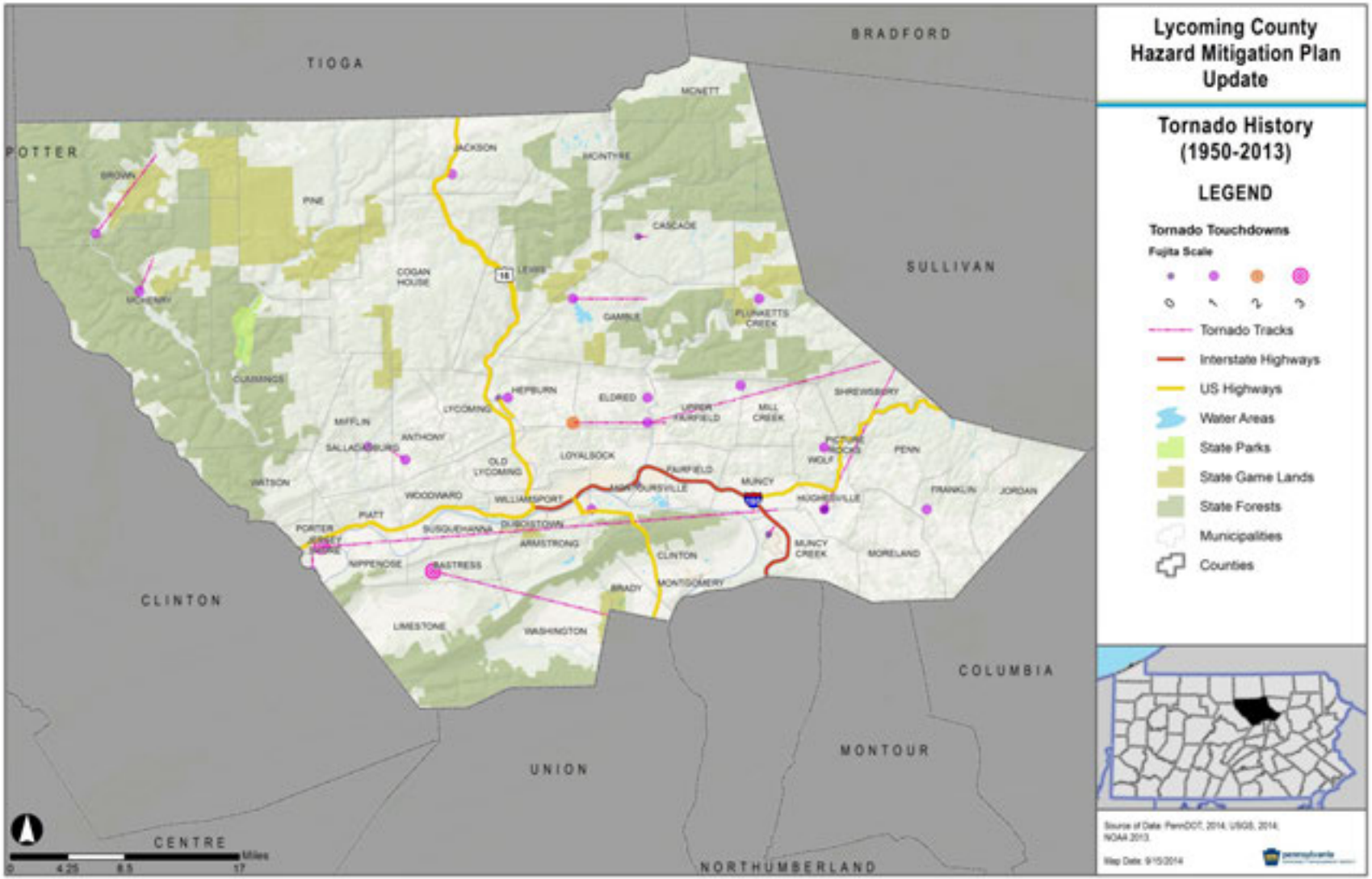
Table 4.3.7-2 **Previous tornado events between 1950 and 2014 in Lycoming County (NCDC, 2014).**

LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	ESTIMATED PROPERTY DAMAGE ($)
County-wide	8/16/1966	F2	0	1	25,000
County-wide	5/10/1973	F1	0	0	250,000
County-wide	7/29/1976	F3	0	0	2,500,000
County-wide	8/2/1979	F1	0	0	25,000
County-wide	5/31/1985	F3	2	20	25,000,000
County-wide	7/13/1986	F1	0	0	25,000
County-wide	8/13/1990	F1	0	0	2,500
Hughesville	6/12/1994	F0	0	0	50,000
Loyalsockville	7/8/1996	F1	0	0	0

Table 4.3.7-2 **Previous tornado events between 1950 and 2014 in Lycoming County (NCDC, 2014).**

LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	ESTIMATED PROPERTY DAMAGE ($)
Jersey Shore	11/8/1996	F1	0	0	100,000
Linden	11/8/1996	F1	0	0	100,000
Buttonwood	5/31/1998	F1	0	0	0
Salladasburg	5/31/1998	F1	0	0	0
Montoursville	5/31/1998	F0	0	0	0
Hughesville	5/31/1998	F0	0	0	0
Picture Rocks	6/16/1998	F1	0	0	0
Picture Rocks	6/16/1998	F1	0	0	0
Bodines	7/1/1999	F0	0	0	10,000
Farragut	6/16/2000	F1	0	0	0
Perryville	5/11/2003	F0	0	0	5,000
Lairdsville	7/21/2003	F1	0	0	10,000
Montoursville	6/6/2005	F1	0	0	0
Barbours	8/31/2005	F1	0	0	0
Muncy	6/19/2007	EF0	0	0	0
Slate Run	5/26/2011	EF1	0	0	8,000
Cammal	5/26/2011	EF1	0	0	6,000
		TOTAL	**2**	**21**	**28,116,000**

Figure 4.3.7-2 **Map showing tornado events and tracks in Lycoming County.**



Windstorm events may be the result of thunderstorms, hurricanes, tropical storms, winter storms, or nor'easters. From 1950 to September 2014, there have been 129 events with wind speeds of greater than 50 knots, as shown in Table 4.3.7-3. These events frequently occurred in conjunction with thunderstorms.

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
County-wide	8/26/1976	Thunderstorm Wind	50 kts.	0	0
County-wide	6/21/1978	Thunderstorm Wind	68 kts.	0	0
County-wide	3/31/1982	Thunderstorm Wind	58 kts.	0	0
County-wide	7/16/1988	Thunderstorm Wind	52 kts.	0	0
County-wide	7/16/1988	Thunderstorm Wind	50 kts.	0	0
Montoursville	11/11/1995	Thunderstorm Wind	51 kts.	0	0
Northern Lycoming (zone)	2/24/1996	High Wind	60 kts.	0	0
Loyalsockville	7/8/1996	Thunderstorm Wind	50 kts.	0	0
Northern Lycoming (zone)	2/13/1997	Winter Storm	NA	0	0
Southern Lycoming (zone)	2/22/1997	High Wind	60 kts.	0	0
Northern Lycoming (zone)	2/22/1997	High Wind	60 kts.	0	0
Williamsport	5/3/1997	Thunderstorm Wind	51 kts.	0	0
Duboistown Borough	5/6/1997	Thunderstorm Wind	51 kts.	0	0
Hughesville	5/6/1997	Thunderstorm Wind	51 kts.	0	0
Williamsport	5/19/1997	Thunderstorm Wind	51 kts.	0	0
Williamsport	7/18/1997	Thunderstorm Wind	51 kts.	0	0
Cedar Run	8/16/1997	Thunderstorm Wind	51 kts.	0	0
Montoursville	8/16/1997	Thunderstorm Wind	50 kts.	0	0
Muncy	8/16/1997	Thunderstorm Wind	51 kts.	0	0
Muncy	8/28/1997	Thunderstorm Wind	51 kts.	0	0
Williamsport	5/29/1998	Thunderstorm Wind	51 kts.	0	0
Muncy	5/31/1998	Thunderstorm Wind	51 kts.	0	0
Glen Mawr	6/16/1998	Thunderstorm Wind	51 kts.	0	0
Jersey Shore	6/30/1998	Thunderstorm Wind	51 kts.	2	0
Montoursville	6/30/1998	Thunderstorm Wind	51 kts.	0	0
Jersey Shore	9/27/1998	Thunderstorm Wind	51 kts.	0	0

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Northern Lycoming (zone)	1/2/1999	Winter Storm	NA	0	0
Southern Lycoming (zone)	1/2/1999	Winter Storm	NA	0	0
Southern Lycoming (zone)	1/8/1999	Winter Storm	NA	0	0
Northern Lycoming (zone)	1/8/1999	Winter Storm	NA	0	0
Southern Lycoming (zone)	1/14/1999	Winter Storm	NA	0	0
Northern Lycoming (zone)	1/14/1999	Winter Storm	NA	0	0
Montoursville	1/18/1999	Thunderstorm Wind	71 kts.	0	0
Northern Lycoming (zone)	9/16/1999	High Wind	60 kts.	0	0
Northern Lycoming (zone)	9/29/1999	High Wind	60 kts.	0	0
Southern Lycoming (zone)	9/29/1999	High Wind	60 kts.	0	0
Southern Lycoming (zone)	2/18/2000	Winter Storm	NA	0	0
Northern Lycoming (zone)	2/18/2000	Winter Storm	NA	0	0
Montoursville	5/18/2000	Thunderstorm Wind	62 kts. M	0	0
Montoursville	6/2/2000	Thunderstorm Wind	51 kts. M	0	0
Southern Lycoming (zone)	12/13/2000	Winter Storm	NA	0	0
Northern Lycoming (zone)	12/13/2000	Winter Storm	NA	0	0
Calvert	4/9/2001	Thunderstorm Wind	50 kts. E	0	0
Moreland	6/20/2001	Thunderstorm Wind	50 kts. E	0	0
Williamsport	6/20/2001	Thunderstorm Wind	50 kts. E	0	0
Wiliamsport	7/1/2001	Thunderstorm Wind	50 kts. E	0	0
Glen Mawr	7/1/2001	Thunderstorm Wind	50 kts. E	0	0
Waterville	8/16/2001	Thunderstorm Wind	50 kts. E	0	0
Trout Run	8/19/2001	Thunderstorm Wind	50 kts. E	0	0
Wiliamsport	8/31/2001	Thunderstorm Wind	50 kts. E	0	0

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Montoursville	8/31/2001	Thunderstorm Wind	50 kts. E	0	0
Picture Rocks	9/13/2001	Thunderstorm Wind	50 kts. E	0	0
Jersey Shore	9/24/2001	Thunderstorm Wind	50 kts. E	0	0
Williamsport	10/16/2001	Thunderstorm Wind	50 kts. E	0	0
Southern Lycoming (zone)	12/14/2001	High Wind	60 kts. E	0	0
Northern Lycoming (zone)	12/14/2001	High Wind	60 kts. E	0	0
Southern Lycoming (zone)	2/1/2002	High Wind	63 kts. M	0	0
Northern Lycoming (zone)	2/1/2002	High Wind	63 kts. M	0	0
Southern Lycoming (zone)	3/9/2002	High Wind	50 kts. E	0	0
Northern Lycoming (zone)	3/9/2002	High Wind	50 kts. E	0	0
Hughesville	3/9/2002	Thunderstorm Wind	60 kts. M	0	0
Calvert	4/28/2002	Thunderstorm Wind	50 kts. E	0	0
Williamsport	4/28/2002	Thunderstorm Wind	50 kts. E	0	0
Williamsport	5/31/2002	Thunderstorm Wind	50 kts. E	0	0
Williamsport	7/28/2002	Thunderstorm Wind	50 kts. E	0	0
Tivoli	7/28/2002	Thunderstorm Wind	50 kts. E	0	0
Hughesville	5/11/2003	Thunderstorm Wind	50 kts. EG	0	$5,000
Jersey Shore	7/18/2003	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	7/21/2003	Thunderstorm Wind	50 kts. EG	0	0
Muncy	7/21/2003	Thunderstorm Wind	50 kts. EG	0	0
Hughesville	7/21/2003	Thunderstorm Wind	50 kts. EG	0	0
Jersey Shore	7/27/2003	Thunderstorm Wind	50 kts. EG	0	0
Trout Run	8/16/2003	Thunderstorm Wind	50 kts. EG	0	0
Picture Rocks	8/29/2003	Thunderstorm Wind	50 kts. EG	0	0
Southern Lycoming (zone)	9/18/2003	Tropical Storm	NA	0	0
Southern Lycoming (zone)	11/13/2003	High Wind	60 kts. EG	0	0
Northern Lycoming (zone)	11/13/2003	High Wind	60 kts. EG	0	0

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Buttonwood	6/14/2004	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	6/17/2004	Thunderstorm Wind	50 kts. EG	0	0
Trout Run	11/25/2004	Thunderstorm Wind	50 kts. EG	0	0
Jersey Shore	11/25/2004	Thunderstorm Wind	50 kts. EG	0	0
Northern Lycoming (zone)	1/5/2005	Winter Storm	NA	0	0
Southern Lycoming (zone)	1/5/2005	Winter Storm	NA	0	0
Northern Lycoming (zone)	1/22/2005	Winter Storm	NA	0	0
Northern Lycoming (zone)	2/21/2005	Winter Storm	NA	0	0
Picture Rocks	6/6/2005	Thunderstorm Wind	50 kts. EG	0	0
Lairdsville	7/13/2005	Thunderstorm Wind	50 kts. EG	0	0
Trout Run	7/26/2005	Thunderstorm Wind	50 kts. EG	0	0
Montgomery	8/2/2005	Thunderstorm Wind	50 kts. EG	0	0
Loyalsockville	8/13/2005	Thunderstorm Wind	50 kts. EG	0	0
Lairdsville	8/13/2005	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	9/29/2005	Thunderstorm Wind	50 kts. EG	0	0
Waterville	11/6/2005	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	11/6/2005	Thunderstorm Wind	50 kts. EG	0	0
Hughesville	11/6/2005	Thunderstorm Wind	50 kts. EG	0	0
Southern Lycoming (zone)	12/16/2005	Winter Storm	NA	0	0
Northern Lycoming (zone)	12/16/2005	Winter Storm	NA	0	0
Southern Lycoming (zone)	2/17/2006	High Wind	52 kts. EG	0	0
Northern Lycoming (zone)	2/17/2006	High Wind	52 kts. EG	0	0
Williamsport	5/30/2006	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	5/30/2006	Thunderstorm Wind	50 kts. EG	0	0
Montgomery	5/30/2006	Thunderstorm Wind	50 kts. EG	0	0
Jersey Shore	6/9/2006	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	6/22/2006	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	6/22/2006	Thunderstorm Wind	50 kts. MG	0	0

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Montoursville	6/22/2006	Thunderstorm Wind	50 kts. EG	0	0
Loyalsockville	6/22/2006	Thunderstorm Wind	50 kts. EG	0	0
Hughesville	6/29/2006	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	7/2/2006	Thunderstorm Wind	50 kts. EG	0	0
Williamsport	8/3/2006	Thunderstorm Wind	50 kts. EG	0	0
Lairdsville	8/25/2006	Thunderstorm Wind	50 kts. EG	0	0
Muncy	11/16/2006	Thunderstorm Wind	50 kts. EG	0	0
Southern Lycoming (zone)	12/1/2006	High Wind	71 kts. MG	1	$5,000
Southern Lycoming (zone)	2/13/2007	Winter Storm	NA	0	0
Newberry	6/8/2007	Thunderstorm Wind	50 kts. EG	0	0
Farragut	6/19/2007	Thunderstorm Wind	50 kts. EG	0	0
Muncy	8/3/2007	Thunderstorm Wind	50 kts. EG	0	0
Muncy	8/3/2007	Thunderstorm Wind	50 kts. EG	0	0
Jersey Shore	9/27/2007	Thunderstorm Wind	50 kts. EG	0	0
Northern Lycoming (zone)	12/13/2007	Winter Storm	NA	0	0
Northern Lycoming (zone)	2/1/2008	Winter Storm	NA	0	0
Southern Lycoming (zone)	2/1/2008	Winter Storm	NA	0	0
Jersey Shore	6/16/2008	Thunderstorm Wind	50 kts. EG	0	0
Lairdsville	7/18/2008	Thunderstorm Wind	50 kts. EG	0	0
Northern Lycoming (zone)	9/14/2008	High Wind	50 kts. EG	0	0
Northern Lycoming (zone)	12/11/2008	Winter Storm	NA	0	0
Southern Lycoming (zone)	12/19/2008	Winter Storm	NA	0	0
Northern Lycoming (zone)	12/19/2008	Winter Storm	NA	0	0
Northern Lycoming (zone)	1/10/2009	Winter Storm	NA	0	0
Southern Lycoming (zone)	1/27/2009	Winter Storm	NA	0	0

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Northern Lycoming (zone)	1/27/2009	Winter Storm	NA	0	0
Southern Lycoming (zone)	2/12/2009	High Wind	50 kts. MG	0	$10,000
Northern Lycoming (zone)	2/12/2009	High Wind	50 kts. MG	0	$10,000
Duboistown Borough	7/11/2009	Thunderstorm Wind	50 kts. EG	0	$5,000
Perryville	7/26/2009	Thunderstorm Wind	50 kts. EG	0	$5,000
Jersey Shore	8/9/2009	Thunderstorm Wind	50 kts. EG	0	$10,000
Jersey Shore	8/18/2009	Thunderstorm Wind	50 kts. EG	0	$5,000
Barbours	8/18/2009	Thunderstorm Wind	50 kts. EG	0	$5,000
Northern Lycoming (zone)	10/15/2009	Winter Storm	NA	0	0
(IPT) Williamsport Ar	12/3/2009	Thunderstorm Wind	55 kts. MG	0	0
Southern Lycoming (zone)	2/9/2010	Winter Storm	NA	0	0
Northern Lycoming (zone)	2/25/2010	Winter Storm	NA	0	0
Newberry	4/8/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Ralston	4/8/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Picture Rocks	4/8/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Cedar Run	7/24/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
East Faxon	7/24/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Larrys Creek	7/24/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Jersey Shore	9/22/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
(IPT) Williamsport Ar	9/22/2010	Thunderstorm Wind	52 kts. MG	0	0
Garden View	9/22/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Muncy	9/22/2010	Thunderstorm Wind	70 kts. EG	2	$15,000
Montoursville	10/11/2010	Thunderstorm Wind	50 kts. EG	0	$5,000
Northern Lycoming (zone)	2/1/2011	Winter Storm	NA	0	0
Northern Lycoming (zone)	3/23/2011	Winter Storm	NA	0	0
Oregon Hill	5/26/2011	Thunderstorm Wind	70 kts. EG	0	$5,000
Hughesville	5/26/2011	Thunderstorm Wind	50 kts. EG	0	$5,000
Lairdsville	5/27/2011	Thunderstorm Wind	50 kts. EG	0	$5,000

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
County-wide	6/9/2011	Thunderstorm Wind	78 kts. EG	0	0
County-wide	6/9/2011	Thunderstorm Wind	50 kts. EG	0	$5,000
White Pine	5/29/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Garden View	6/1/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Loyalsockville	7/7/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Picture Rocks	7/7/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Williamsport	7/7/2012	Thunderstorm Wind	50 kts. EG	0	$10,000
(IPT) Williamsport Ar	7/7/2012	Thunderstorm Wind	50 kts. MG	0	0
South Williamsport	7/15/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Jersey Shore	7/26/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Marsh Hill	7/26/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Linden	7/26/2012	Thunderstorm Wind	50 kts. EG	0	$2,500
Newberry	7/26/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
(IPT) Williamsport Ar	7/26/2012	Thunderstorm Wind	51 kts. MG	0	0
Clarkstown	7/26/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Waterville	8/9/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Powys	8/9/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Newberry	9/8/2012	Thunderstorm Wind	50 kts. EG	0	$5,000
Clarkstown	9/8/2012	Thunderstorm Wind	50 kts. EG	0	0
Southern Lycoming (zone)	10/29/2012	High Wind	50 kts. EG	0	0
Northern Lycoming (zone)	10/29/2012	High Wind	50 kts. EG	0	0
Southern Lycoming (zone)	12/26/2012	Winter Storm	NA	0	0
Northern Lycoming (zone)	12/26/2012	Winter Storm	NA	0	0
(IPT) Williamsport Ar	4/10/2013	Thunderstorm Wind	50 kts. MG	0	0
Halls	4/10/2013	Thunderstorm Wind	50 kts. EG	0	$10,000
Montoursville	4/10/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Muncy	4/19/2013	Thunderstorm Wind	61 kts. EG	0	$10,000
Picture Rocks	4/19/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Calvert	5/22/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Waterville	5/22/2013	Thunderstorm Wind	50 kts. EG	0	$2,000

Table 4.3.7-3 **Previous wind events over 50 knots (NCDC, 2014).**

LOCATION	DATE	TYPE	WIND SPEED	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Cammal	5/22/2013	Thunderstorm Wind	50 kts. EG	0	$2,000
Trout Run	5/22/2013	Thunderstorm Wind	50 kts. EG	0	$2,000
Picture Rocks	5/22/2013	Thunderstorm Wind	50 kts. EG	0	0
Hughesville	6/24/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Williamsport	7/7/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Newberry	7/7/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Hughesville	7/7/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Williamsport	7/28/2013	Thunderstorm Wind	50 kts. EG	0	$2,000
County-wide	9/11/2013	Thunderstorm Wind	50 kts. EG	0	$2,000
County-wide	9/11/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
County-wide	9/12/2013	Thunderstorm Wind	50 kts. EG	0	$2,000
County-wide	9/12/2013	Thunderstorm Wind	50 kts. EG	0	$5,000
Southern Lycoming (zone)	2/4/2014	Winter Storm	NA	0	0
Northern Lycoming (zone)	2/4/2014	Winter Storm	NA	0	0
Brookside	5/21/2014	Thunderstorm Wind	50 kts. EG	0	$1,000
English Center	5/21/2014	Thunderstorm Wind	50 kts. EG	0	$1,000
Muncy	5/27/2014	Thunderstorm Wind	50 kts. EG	0	$500
Unityville	5/27/2014	Thunderstorm Wind	50 kts. EG	0	$500
			TOTAL	**5**	**$302,500**

4.3.7.4. Future Occurrence

The probability of the County and its municipalities experiencing severe winds is difficult to quantify, but is considered high. The County experiences strong winds on frequent basis, and when those winds do strike, it can result in significant property damage, trees down, and utility outages.

The probability of a tornado striking the County is relatively high compared to the rest of the Commonwealth, with 21 occurring since 1950. Those that have occurred were relatively weak and caused little destruction, though there have been notable exceptions (described above). Most of Pennsylvania is susceptible to tornadoes of a magnitude of at most an EF-3. It can reasonably be assumed that future tornadoes will be similar in nature to those that have affected the County in the past, and will strike the County once every two years. On the whole, though, the probability of future tornado and windstorm events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.7.5. Vulnerability Assessment

All critical facilities in Lycoming 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). Individual structure data was not available for this study, so it was difficult to determine the exact number and types of structures within Lycoming County that have heightened vulnerability to wind hazards. However, mobile homes and commercial trailers are extremely vulnerable to high winds (especially if they are not well anchored).

As discussed in Section 2.5, Lycoming County's structures database does not provide structure types. However, the County advised using a combination of the structures and parcel database, which does have property type, to identify the number and type of structures of mobile homes in Lycoming County. Table 4.3.7-4 shows the number of structures on mobile home parcels in Lycoming County. The highest proportions of structures on mobile home parcels are in Cascade Township, Mifflin Township, Old Lycoming Township, Pine Township, and Shrewsbury Township. All municipalities except Hughesville, Montoursville, and South Williamsport Boroughs have at least one structure.

Table 4.3.7-4 **Mobile homes per jurisdiction (Lycoming County GIS)**

MUNICIPALITY	TOTAL STRUCTURES	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS	PERCENT STRUCTURES ON MOBILE HOME PARCELS
Anthony Township	389	22	5.7%
Armstrong Township	533	2	0.4%
Bastress Township	253	6	2.4%
Brady Township	351	19	5.4%
Brown Township	428	11	2.6%
Cascade Township	351	48	13.7%
Clinton Township	12,248	97	0.8%
Cogan House Township	1,536	58	3.8%
Cummings Township	1,044	43	4.1%
Duboistown Borough	843	5	0.6%
Eldred Township	733	25	3.4%
Fairfield Township	968	17	1.8%
Franklin Township	1,484	36	2.4%
Gamble Township	609	22	3.6%
Hepburn Township	603	38	6.3%
Hughesville Borough	1,467	0	0.0%
Jackson Township	967	17	1.8%
Jersey Shore Borough	331	21	6.3%

Table 4.3.7-4 **Mobile homes per jurisdiction (Lycoming County GIS)**

MUNICIPALITY	TOTAL STRUCTURES	NUMBER OF STRUCTURES ON MOBILE HOME PARCELS	PERCENT STRUCTURES ON MOBILE HOME PARCELS
Jordan Township	2,356	60	2.5%
Lewis Township	565	50	8.8%
Limestone Township	820	53	6.5%
Loyalsock Township	1,397	18	1.3%
Lycoming Township	5,344	76	1.4%
McHenry Township	966	60	6.2%
McIntyre Township	728	47	6.5%
McNett Township	419	23	5.5%
Mifflin Township	254	45	17.7%
Mill Creek Township	581	22	3.8%
Montgomery Borough	313	1	0.3%
Montoursville Borough	805	0	0.0%
Moreland Township	2,254	38	1.7%
Muncy Borough	583	1	0.2%
Muncy Township	1,117	18	1.6%
Muncy Creek Township	1,970	69	3.5%
Nippenose Township	655	16	2.4%
Old Lycoming Township	558	77	13.8%
Penn Township	3,091	32	1.0%
Piatt Township	572	48	8.4%
Picture Rocks Borough	866	1	0.1%
Pine Township	300	59	19.7%
Plunketts Creek Township	556	35	6.3%
Porter Township	711	54	7.6%
Salladasburg Borough	870	4	0.5%
Shrewsbury Township	145	17	11.7%
South Williamsport Borough	298	0	0.0%
Susquehanna Township	2,899	19	0.7%
Upper Fairfield Township	738	26	3.5%
Washington Township	915	89	9.7%
Watson Township	1,298	20	1.5%
Williamsport City	511	3	0.6%
Wolf Township	1,550	37	2.4%
Woodward Township	1,643	39	2.4%
TOTAL	**63,786**	**1,644**	**2.6%**

4.3.8. Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. An urban-wildland interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

The U.S. Fire Administration (USFA) collects data from a variety of sources to provide a statistical analysis of fire incidents nationwide. According to the USFA, the number of fires, fire casualties, and economic losses has continued to decline over the last several years. From 1992 to 2001, fires per million population declined 204 percent, deaths per million declined 30 percent, and dollar loss per capita declined 6 percent. This data is confirmed by comparing it with the National Fire Protection Administration's (NFPA) data on national fire trends from 1977 to 2004. The NFPA data shows that in 1977, there was a total of 3,264,000 fires nationwide, resulting in 7,395 civilian deaths and 31,190 civilian injuries. In 2004, this number dropped to a total of 1,550,500 fires, 3,900 civilian deaths, and 17,785 civilian injuries nationwide. A 2001 study by the USFA showed the largest number of fires were classified as "outside/other" and accounted for 41 percent of all fires, while residential fires resulted in the highest percentage of fire deaths (77%), fire injuries (73%), and dollar loss (54%). Nonresidential properties, such as industrial and commercial establishments, institutions, and educational facilities, accounted for only 8 percent of all fires, but 28 percent of total dollar loss.

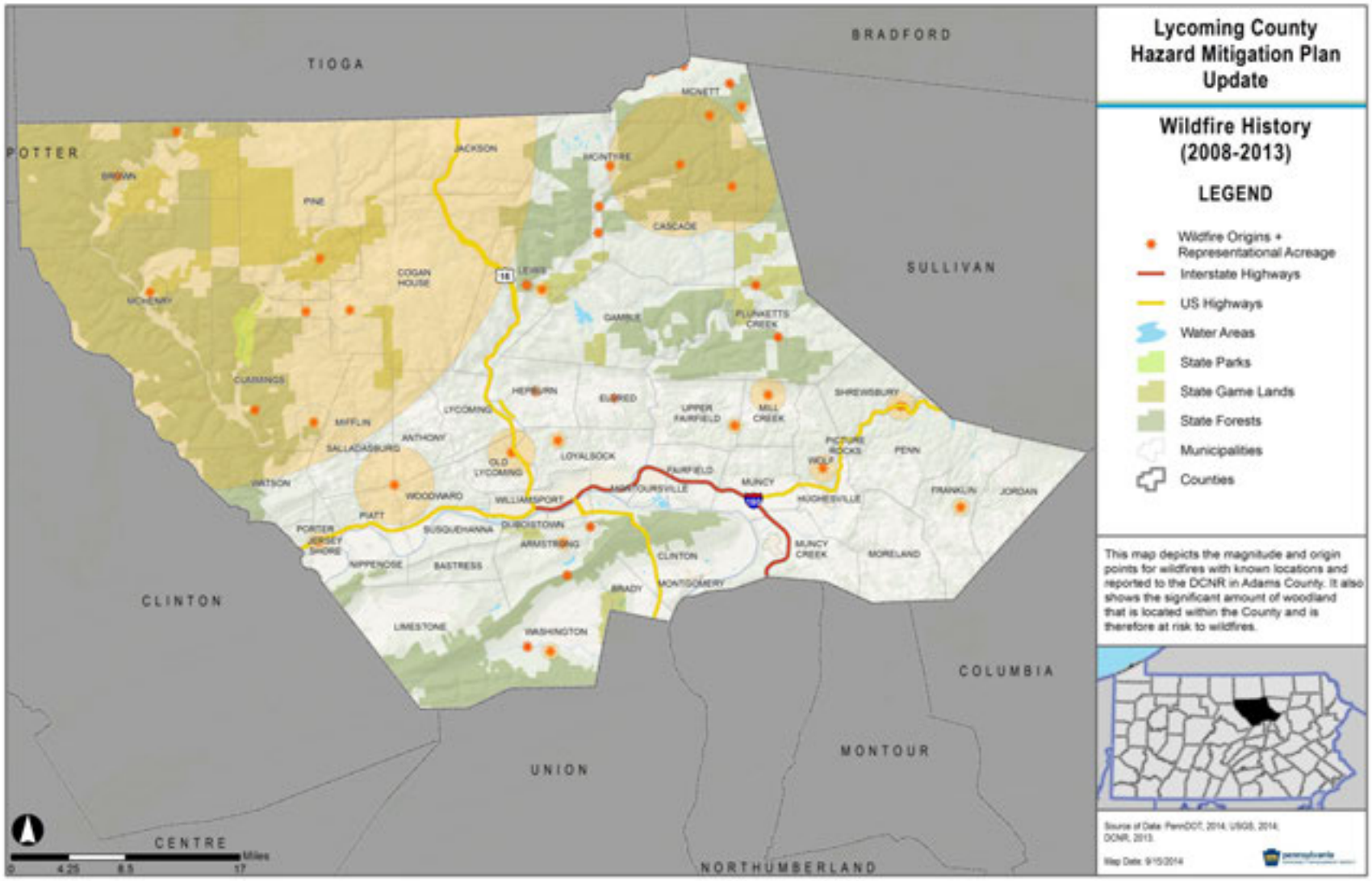
From 1992 to 2001, Pennsylvania had an average fire death rate above the national average, with an average between 11 to 17 per million population. This is due primarily to the state's high population density. In 2001, Pennsylvania averaged 3.01 civilian deaths per 1,000 fires and $22,609 in property loss per fire. In 2003, the USFA recorded a fire death rate of 15.9 per million for Pennsylvania. This was above the 2003 national average of 14.4 per million and ranked the Commonwealth as the fifteenth highest state that year.

4.3.8.1. Location and Extent

Wildland fires can occur at any time of the year, but are most likely to occur in the County during a drought. Wildland fires in Pennsylvania can occur in fields, grass, and brush as well as in the forest itself. Under dry conditions or drought, wildfires have the potential to burn forests as well as croplands. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildland fires are caused by human carelessness, negligence, and ignorance. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion.

Figure 4.3.8-1 shows the origins of wildfires in the past as well as the fact that the vast majority of the County is forestland, with several state parks and forests. Any area with forest or brush is vulnerable to wildfires.

Figure 4.3.8-1 **Map showing location of wildfire events with known locations reported to DCNR in Lycoming County from 2008-2013 (PADCNR-BOF, 2013).**



4.3.8.2. Range of Magnitude

Wildland fires in Lycoming County have generally been small and easily contained. There have been a few that have burned over 100 acres, but most are confined to 10 acres or less. The fact that Lycoming County's land use is mostly forest or agricultural has led to no property damage being done by these fires. The worst wildfire to occur within the County burned about 4,000 acres, though it caused no property damage, injuries, or deaths. However, the County recognizes that wildfires of this magnitude will continue to occur in Lycoming County, and will have more devastating effects as development in or around wildlands increases.

4.3.8.3. Past Occurrence

Between 2002 and 2012, there have been 66 major wildfires in the Lycoming County, resulting in more than 5,000 acres of forest being destroyed. According to DCNR, the worst burning wildfire was 4,000 acres 18 acres in Brown Township in 2008. Table 4.3.8-1 lists all wildfire events in Lycoming County reported to DCNR from 2002 to 2012.

Table 4.3.8-1 **Wildfire events reported to DCNR from 2002 to 2012.**

YEAR	MUNICIPALITY	ACRES BURNED	YEAR	LOCATION	ACRES BURNED
2002	McHenry Township	1.7	2008	Lewis Township	0.4
2002	Cummings Township	129	2008	Lewis Township	0.5
2002	Cummings Township	0.8	2008	Loyalsock Township	2.5
2002	Cummings Township	7.6	2008	McIntyre Township	0.6
2004	Cummings Township	0.3	2008	McNett Township	4.8
2004	Cummings Township	0.6	2008	McNett Township	1.9
2005	Armstrong Township	0.8	2008	Mill Creek Township	10
2005	Moreland Township	1.3	2008	Penn Township	7
2005	McHenry Township	21.7	2008	Plunketts Creek	0.1
2005	McHenry Township	5.3	2008	Upper Fairfield	2
2006	Washington Township	0.8	2008	Wolf Township	6.1
2006	Cummings Township	605	2009	Armstrong Township	2
2006	Porter Township	0.1	2009	Brown Township	0.3
2006	Armstrong Township	0.1	2009	Cascade Township	62.3
2006	Clinton Township	0.3	2009	Franklin Township	2.4
2006	Williamsport	4.5	2009	Hepburn Township	1
2007	McHenry Township	0.1	2009	Jersey Shore Boro	4
2007	Mifflin Township	2	2009	Lewis Township	2.6
2007	Mifflin Township	10	2009	McHenry Township	10
2007	Cogan House Township	0.1	2009	McIntyre Township	0.5
2007	McHenry Township	0.1	2009	Washington Township	0.0
2007	Washington Township	2	2010	McIntyre Township	161
2007	Armstrong Township	0.1	2010	Washington Township	2.5
2007	Woodward Township	6	2010	Washington Township	0.3

Table 4.3.8-1 **Wildfire events reported to DCNR from 2002 to 2012.**

YEAR	MUNICIPALITY	ACRES BURNED	YEAR	LOCATION	ACRES BURNED
2007	Cummings Township	135	2011	Cogan House Township	25
2007	Cummings Township	1.5	2011	Cogan House Township	15
2007	Moreland Township	0.7	2011	McNett Township	0.1
2007	McIntyre Township	0.1	2012	Anthony Township	29.6
2007	Lewis Township	0.2	2012	Cummings Township	10.3
2007	Armstrong Township	6.0	2012	Cummings Township	0.2
2008	Armstrong Township	0.1	2012	McNett Township	0.3
2008	Brown Township	4,000	2012	Old Lycoming Township	18.0
2008	Eldred Township	0.1	2012	Pine Township	50

Location information was available for wildfires from 2008-2013 from DCNR. As shown in Figure 4.3.8-1, wildfires have occurred all over Lycoming County, with the largest occurring in the portions with park land concentrations. Park lands, as wooded, remote spaces, are potentially more vulnerable to future wildfires.

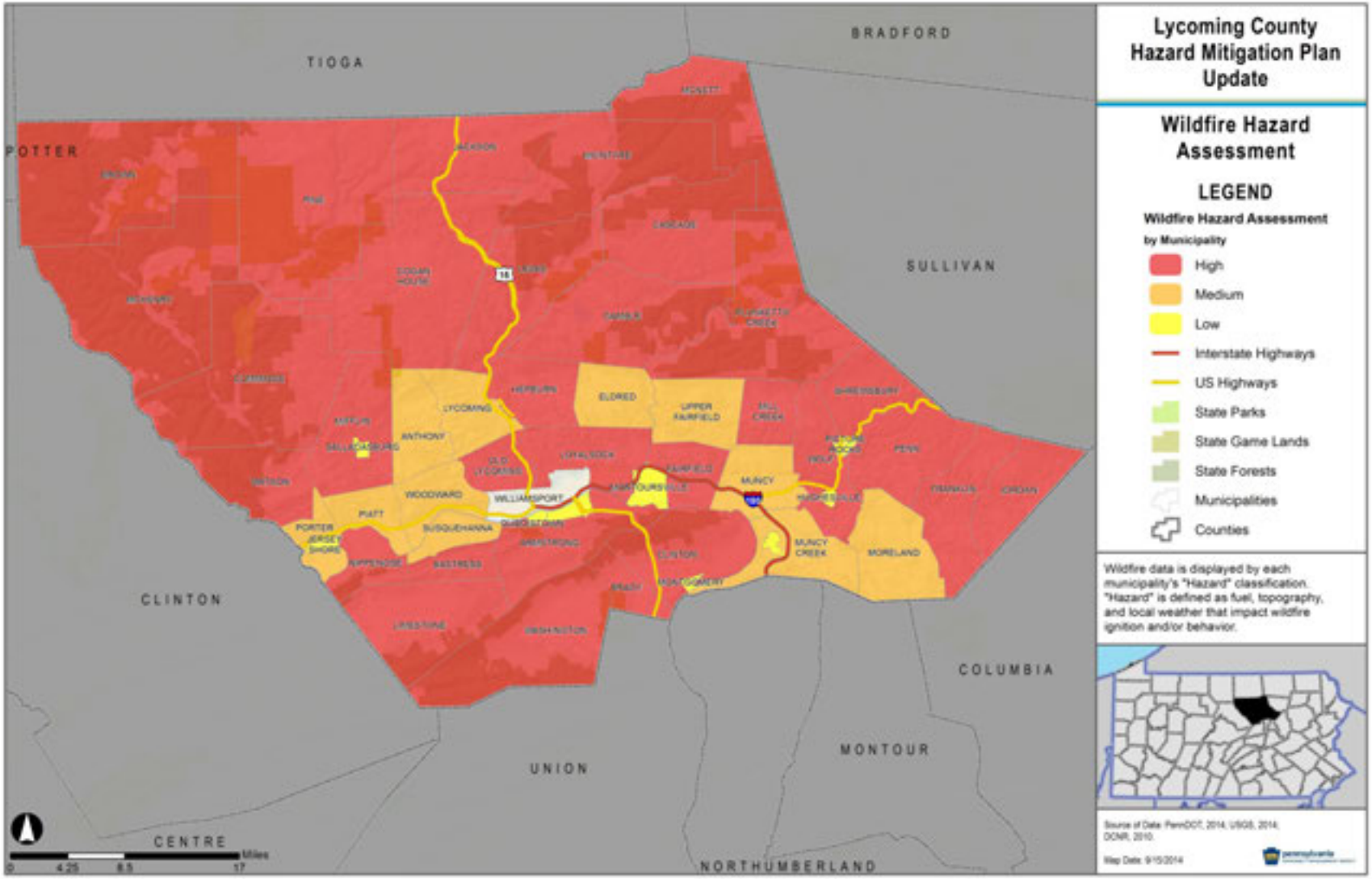
4.3.8.4. Future Occurrence

Wildland fires are most common in the spring (March to May) and fall (October to November) months. During spring months, the lack of leaves on the trees allows the sunlight to heat the existing leaves on the ground from the previous fall. The same theory applies for the fall; however, the dryer conditions are a more crucial factor. Though there have been years with no wildfires reported, it is likely that wildfires will affect the County every year. Based on data from 2002 through 2009, Lycoming County can expect between zero and 14 wildfires each year, with an average of between five and six. On the whole, though, the probability of future wildfire events can be considered *likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.8.5. Vulnerability Assessment

The Pennsylvania Bureau of Forestry has conducted an independent wildfire hazard risk assessment for the various municipalities across Lycoming County. Results of that assessment are shown in Figure 4.3.8-2. *Wildfire hazard* is defined based on conditions that affect wildfire ignition and/or behavior such as fuel, topography and local weather. Based on this assessment, 31 jurisdictions in Lycoming County have a *high* wildfire rating. Eleven municipalities have a *medium* wildfire hazard potential, and nine municipalities have a *low* wildfire hazard potential. A wildfire hazard assessment was not completed for the City of Williamsport, though it is assumed that with the density of development and limited open space, the chance of wildfire in Williamsport is also low. The individual vulnerability of communities will differ based on the design of the urban/wildland interface, the number of ingress and egress points into a community, and the availability of water to fight fires.

Figure 4.3.8-2 **Map showing wildfire *hazard* by jurisdiction across Lycoming County.**



Wildfires have the potential to destroy huge areas of vegetation with no regard to the man-made structures within those areas. The rural areas in which these fires occur generally have little firefighting infrastructure such as hydrants, and the fire departments servicing those areas may take extended times to reach and ultimately extinguish the fire. Recognizing that these fires have the potential to spread relatively unopposed, the most vulnerable people and property are those within and near wooded areas. For the purpose of this document, that distance is defined as in or within 2 miles of state forests, state parks, and state game lands, as they are the largest continuous tracks of wooded land in Lycoming County. Table 4.3.8-2 shows the number of structures and critical facilities in wooded areas of Lycoming County, and Table 4.3.8-3 shows the number of structures vulnerable to wildfires by generalized property type.

Table 4.3.8-2 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County, defined as in or within 2 miles.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN/NEAR STATE RECREATION AREAS	% OF STRUCTURES IN/NEAR STATE RECREATION AREAS	TOTAL CRITICAL FACILITIES	TOTAL CRITICAL IN/NEAR STATE RECREATION AREAS	% CRITICAL FACILITIES IN/NEAR STATE RECREATION AREAS
Anthony Township	389	117	30.1%	6	1	16.7%
Armstrong Township	533	533	100.0%	2	2	100.0%
Bastress Township	253	40	15.8%	4	0	0.0%
Brady Township	351	350	99.7%	3	3	100.0%
Brown Township	428	428	100.0%	4	4	100.0%
Cascade Township	351	350	99.7%	4	4	100.0%
Clinton Township	1,536	1,264	82.3%	21	20	95.2%
Cogan House Township	1,044	622	59.6%	11	6	54.5%
Cummings Township	843	838	99.4%	4	4	100.0%
Duboistown Borough	733	733	100.0%	8	8	100.0%
Eldred Township	968	643	66.4%	5	5	100.0%
Fairfield Township	1,484	994	67.0%	12	12	100.0%
Franklin Township	609	141	23.2%	10	2	20.0%
Gamble Township	603	588	97.5%	4	4	100.0%
Hepburn Township	1,467	114	7.8%	12	0	0.0%
Hughesville Borough	967	0	0.0%	21	0	0.0%
Jackson Township	331	90	27.2%	2	1	50.0%
Jersey Shore Borough	2,356	627	26.6%	39	10	25.6%
Jordan Township	565	231	40.9%	8	0	0.0%
Lewis Township	820	556	67.8%	7	7	100.0%
Limestone Township	1,397	1,231	88.1%	14	10	71.4%

Table 4.3.8-2 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County, defined as in or within 2 miles.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN/NEAR STATE RECREATION AREAS	% OF STRUCTURES IN/NEAR STATE RECREATION AREAS	TOTAL CRITICAL FACILITIES	TOTAL CRITICAL IN/NEAR STATE RECREATION AREAS	% CRITICAL FACILITIES IN/NEAR STATE RECREATION AREAS
Loyalsock Township	5,344	877	16.4%	54	8	14.8%
Lycoming Township	966	2	0.2%	6	0	0.0%
McHenry Township	728	728	100.0%	5	5	100.0%
McIntyre Township	419	419	100.0%	8	8	100.0%
McNett Township	254	254	100.0%	2	2	100.0%
Mifflin Township	581	144	24.8%	6	1	16.7%
Mill Creek Township	313	186	59.4%	4	2	50.0%
Montgomery Borough	805	531	66.0%	14	6	42.9%
Montoursville Borough	2,257	1,931	85.6%	32	31	96.9%
Moreland Township	583	45	7.7%	7	0	0.0%
Muncy Borough	1,117	533	47.7%	17	8	47.1%
Muncy Creek Township	1,970	569	28.9%	21	6	28.6%
Muncy Township	655	237	36.2%	14	4	28.6%
Nippenose Township	558	552	98.9%	7	7	100.0%
Old Lycoming Township	3,091	1,054	34.1%	22	7	31.8%
Penn Township	573	22	3.8%	2	0	0.0%
Piatt Township	866	188	21.7%	5	0	0.0%
Picture Rocks Borough	300	0	0.0%	9	0	0.0%
Pine Township	556	530	95.3%	3	3	100.0%
Plunketts Creek Township	711	711	100.0%	7	7	100.0%
Porter Township	870	457	52.5%	7	2	28.6%
Salladasburg Borough	145	0	0.0%	2	0	0.0%
Shrewsbury Township	298	72	24.2%	2	0	0.0%
South Williamsport Borough	2,899	2,899	100.0%	28	28	100.0%
Susquehanna Township	738	520	70.5%	6	5	83.3%
Upper Fairfield Township	915	516	56.4%	14	10	71.4%
Washington Township	1,298	1,298	100.0%	11	11	100.0%

Table 4.3.8-2 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County, defined as in or within 2 miles.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN/NEAR STATE RECREATION AREAS	% OF STRUCTURES IN/NEAR STATE RECREATION AREAS	TOTAL CRITICAL FACILITIES	TOTAL CRITICAL IN/NEAR STATE RECREATION AREAS	% CRITICAL FACILITIES IN/NEAR STATE RECREATION AREAS
Watson Township	511	509	99.6%	1	1	100.0%
Williamsport City	12,248	8,246	67.3%	129	96	74.4%
Wolf Township	1,551	105	6.8%	15	2	13.3%
Woodward Township	1,643	100	6.1%	14	3	21.4%
TOTAL	**63,791**	**34,725**	**54.4%**	**675**	**366**	**54.2%**

Table 4.3.8-3 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN AND NEAR AREAS VULNERABLE TO WILDFIRE						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Anthony Township	389	0	0	0	110	2	5	117
Armstrong Township	533	24	86	18	359	1	45	533
Bastress Township	253	0	0	0	40	0	0	40
Brady Township	351	3	24	0	241	0	82	350
Brown Township	428	2	17	0	317	0	92	428
Cascade Township	351	6	4	0	318	2	20	350
Clinton Township	1,536	24	183	23	999	5	30	1,264
Cogan House Township	1,044	17	13	0	561	1	30	622
Cummings Township	843	3	324	0	483	0	28	838
Duboistown Borough	733	0	54	0	669	0	10	733
Eldred Township	968	20	17	1	599	1	5	643
Fairfield Township	1,484	6	450	8	500	6	24	994
Franklin Township	609	7	2	0	128	0	4	141
Gamble Township	603	17	14	3	532	0	22	588
Hepburn Township	1,467	0	0	0	0	0	0	0
Hughesville Borough	967	7	7	0	100	0	0	114
Jackson Township	331	2	0	0	71	0	17	90
Jersey Shore Borough	2,356	0	126	0	498	0	3	627
Jordan Township	565	4	24	0	203	0	0	231
Lewis Township	820	92	33	5	381	1	44	556
Limestone Township	1,397	23	18	12	1,135	5	38	1,231
Loyalsock Township	5,344	0	276	16	578	1	6	877

Table 4.3.8-3 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN AND NEAR AREAS VULNERABLE TO WILDFIRE						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Lycoming Township	966	0	0	0	2	0	0	2
McHenry Township	728	9	56	0	576	2	85	728
McIntyre Township	419	3	39	12	316	3	46	419
McNett Township	254	9	13	0	205	0	27	254
Mifflin Township	581	4	0	0	134	1	5	144
Mill Creek Township	313	3	2	0	174	1	6	186
Montgomery Borough	805	0	33	16	479	1	2	531
Montoursville Borough	2,257	0	270	37	1,613	2	9	1,931
Moreland Township	583	4	0	0	41	0	0	45
Muncy Borough	1,117	0	27	2	499	0	5	533
Muncy Creek Township	1,970	26	60	5	464	1	13	569
Muncy Township	655	9	98	3	119	1	7	237
Nippenose Township	558	13	73	0	445	5	16	552
Old Lycoming Township	3,091	0	128	18	896	0	12	1,054
Penn Township	573	2	0	0	19	0	1	22
Piatt Township	866	2	40	0	140	0	6	188
Picture Rocks Borough	300	0	0	0	0	0	0	0
Pine Township	556	45	19	0	437	0	29	530
Plunketts Creek Township	711	50	54	3	538	2	64	711
Porter Township	870	9	16	5	423	1	3	457
Salladasburg Borough	145	0	0	0	0	0	0	0

Table 4.3.8-3 **Structures and critical facilities located in and near state parks, state forests, and state game lands in Lycoming County by generalized property type.**

MUNICIPALITY	TOTAL STRUCTURES	STRUCTURES IN AND NEAR AREAS VULNERABLE TO WILDFIRE						
		AGRICULTURAL	COMMERCIAL	INDUSTRIAL	RESIDENTIAL	TRANSPORTATION/ UTILITIES	UNKNOWN	GRAND TOTAL
Shrewsbury Township	298	2	2	0	66	0	2	72
South Williamsport Borough	2,899	7	285	21	2,550	6	30	2,899
Susquehanna Township	738	1	18	0	495	1	5	520
Upper Fairfield Township	915	8	95	0	401	2	10	516
Washington Township	1,298	40	14	0	1,213	1	30	1,298
Watson Township	511	13	41	0	438	0	17	509
Williamsport City	12,248	29	1,832	148	6,115	16	106	8,246
Wolf Township	1,551	2	0	0	99	0	4	105
Woodward Township	1,643	11	12	10	65	0	2	100
TOTAL	**63,791**	**558**	**4,899**	**366**	**27,784**	**71**	**1,047**	**34,725**

4.3.9. Winter Storm

4.3.9.1. Location and Extent

Winter storms consist of cold temperatures and heavy snow or ice. Because winter storms are regular annual occurrences in Pennsylvania, 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.

Winter storms occur on the average of five times a year in Pennsylvania. Every county in the Commonwealth is subject to severe winter storms, although the northern tier, western counties, and mountainous regions tend to experience these storms more frequently and with greater severity.

Average annual snowfall in Lycoming County ranges from 30 to 50 inches, with the higher snowfall occurring in the northwest portion of the County. See Figure 4.3.9-1 for the mean annual snowfall in Pennsylvania.

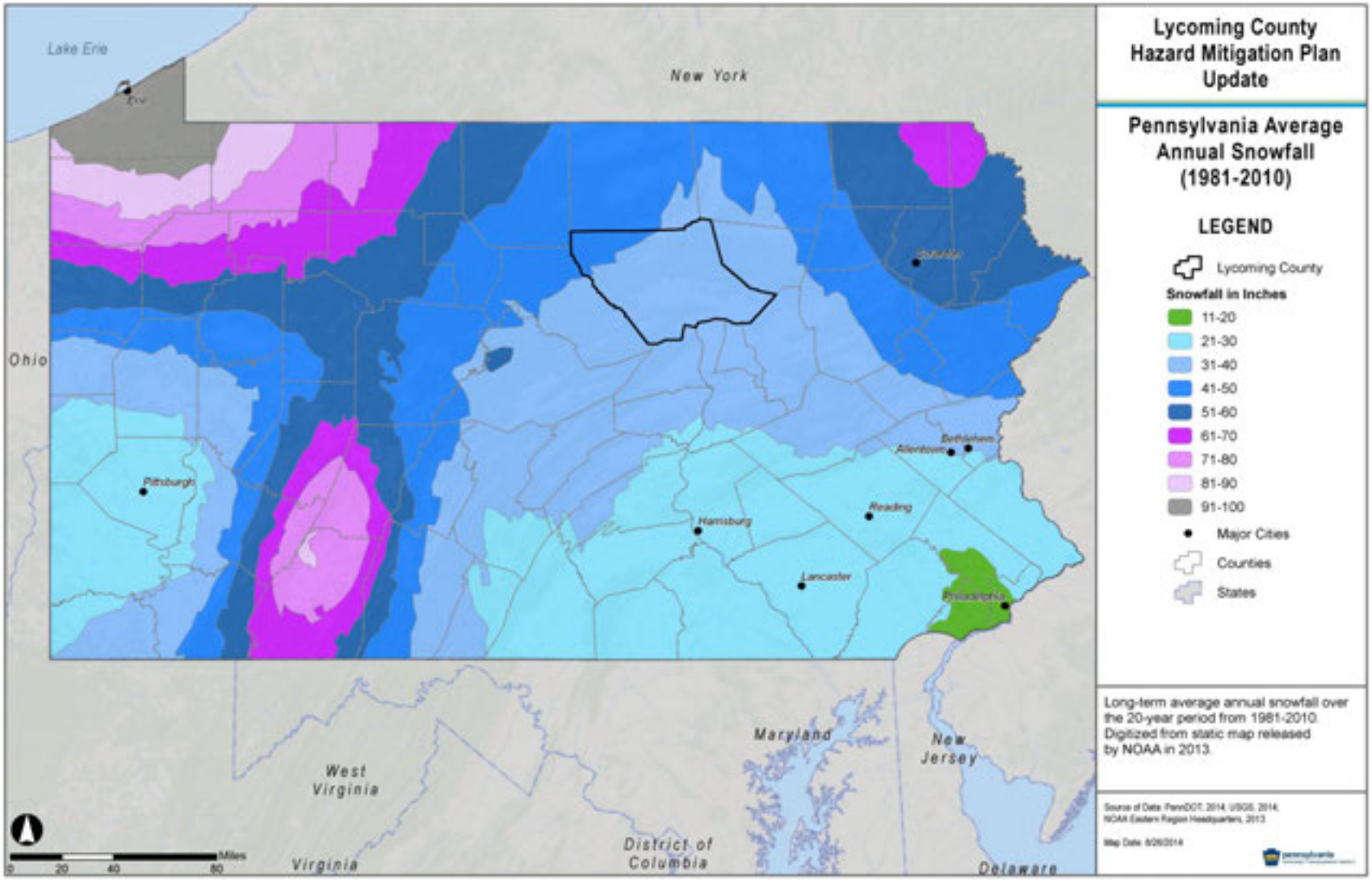
4.3.9.2. Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice and sometimes strong winds. They begin as low-pressure systems that move through Pennsylvania usually following the jet stream. Due to their regular occurrence, these storms are considered hazards only when they result in damage to specific structures or cause disruption to traffic, communications, electric power, or other utilities.

A winter storm can adversely affect roadways, utilities, business activities, and can cause loss of life, frostbite and freezing conditions. They can result in the closing of secondary roads, particularly in rural locations, loss of utility services and depletion of oil heating supplies. These storms typically fall into one of the following categories:

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

Figure 4.3.9-1 **Pennsylvania mean annual snowfall (NOAA NWS, 2012).**



Storms tracking up the east coast tap into Atlantic moisture, whereas the Great Lakes supply the moisture and instability for heavy snow squalls in the northwest. Orographic lift enhances snowfall over higher elevations (note particularly higher average snowfall in Somerset County in the Allegheny Mountains). The snowfall season is November through April, and amounts are generally below one inch during October and May. The greatest monthly snowfalls occur in March as moisture supply begins to increase with rising temperatures.

Some rural areas of the County are susceptible to isolation during winter storms due to power and communication loss as well as road closings. Emergency medical, food, and fuel supplies are sometimes required during these storms.

In Lycoming County, a devastating winter storm occurred in early January 1994. This storm caused record snowfall depths (in excess of 33 inches in some portions of the Commonwealth), strong winds, and sleet/freezing rains. Numerous storm-related power outages were reported, and as many as 600,000 residents were without electricity, in some cases for several days at a time. An intense ice storm followed that affected the Commonwealth and 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.

Environmental impacts often include damage shrubbery and trees due to heavy snow loading, ice build-up and/or high winds which can break limbs or even bring down large trees. An indirect effect of winter storms is the treatment of roadway surfaces with salt, chemicals, and other de-icing materials which can impair adjacent surface and ground waters. Another important secondary impact for winter storms is building or structure collapses; if there is a heavy snowfall or a significant accumulation over time, the weight of the snow may cause building damage or even collapse.

Winter storms have a positive environmental impact as well; gradual melting of snow and ice provides excellent groundwater recharge. However, abrupt high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

4.3.9.3. Past Occurrence

Lycoming County has experienced many major winter storms. In January 1978 and February 1992, emergencies were declared statewide because of heavy snow. In February 1978, March 1989, and March 1993, emergencies were declared due to blizzard conditions – high winds with snow.

The Commonwealth of Pennsylvania has a long history of severe winter weather. In the winter of 1993-1994, 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). Lycoming 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.

Table 4.3.9-1 presents a history of the winter storms that have affected Lycoming County. Since 2010, Lycoming County has witnessed 9 heavy snow events and 8 winter storms.

Table 4.3.9-1 **Previous winter storms events in Lycoming County from 1996-2014 (NCDC, 2014).**

LOCATION	DATE	TYPE	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Northern Lycoming (zone)	1/2/1996	Heavy Snow	0	0
Southern Lycoming (zone)	1/2/1996	Heavy Snow	0	0
Southern Lycoming (zone)	1/7/1996	Blizzard	0	0
Southern Lycoming (zone)	1/12/1996	Heavy Snow	0	0
Northern Lycoming (zone)	1/12/1996	Heavy Snow	0	0
Northern Lycoming (zone)	3/7/1996	Heavy Snow	0	0
Southern Lycoming (zone)	3/7/1996	Heavy Snow	0	0
Northern Lycoming (zone)	1/27/1997	Heavy Snow	0	0
Northern Lycoming (zone)	2/13/1997	Winter Storm	0	0
Southern Lycoming (zone)	3/14/1997	Ice Storm	0	0
Northern Lycoming (zone)	3/14/1997	Ice Storm	0	0
Northern Lycoming (zone)	11/14/1997	Heavy Snow	0	0
Northern Lycoming (zone)	12/10/1997	Heavy Snow	0	0
Northern Lycoming (zone)	12/29/1997	Heavy Snow	0	0
Southern Lycoming (zone)	12/29/1997	Heavy Snow	0	0
Southern Lycoming (zone)	1/15/1998	Ice Storm	0	0
Northern Lycoming (zone)	1/15/1998	Ice Storm	0	0
Southern Lycoming (zone)	1/22/1998	Ice Storm	0	0
Northern Lycoming (zone)	1/22/1998	Ice Storm	0	0
Northern Lycoming (zone)	2/23/1998	Heavy Snow	0	0
Northern Lycoming (zone)	1/2/1999	Winter Storm	0	0
Southern Lycoming (zone)	1/2/1999	Winter Storm	0	0
Southern Lycoming (zone)	1/8/1999	Winter Storm	0	0
Northern Lycoming (zone)	1/8/1999	Winter Storm	0	0
Southern Lycoming (zone)	1/14/1999	Winter Storm	0	0
Northern Lycoming (zone)	1/14/1999	Winter Storm	0	0
Southern Lycoming (zone)	2/7/1999	Heavy Snow	0	0
Northern Lycoming (zone)	2/7/1999	Heavy Snow	0	0
Northern Lycoming (zone)	3/6/1999	Heavy Snow	0	0
Northern Lycoming (zone)	3/21/1999	Heavy Snow	0	0
Southern Lycoming (zone)	1/25/2000	Heavy Snow	0	0
Northern Lycoming (zone)	1/25/2000	Heavy Snow	0	0
Northern Lycoming (zone)	1/30/2000	Heavy Snow	0	0

Table 4.3.9-1 **Previous winter storms events in Lycoming County from 1996-2014 (NCDC, 2014).**

LOCATION	DATE	TYPE	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Southern Lycoming (zone)	1/30/2000	Heavy Snow	0	0
Southern Lycoming (zone)	2/13/2000	Ice Storm	0	0
Northern Lycoming (zone)	2/13/2000	Ice Storm	0	0
Southern Lycoming (zone)	2/18/2000	Winter Storm	0	0
Northern Lycoming (zone)	2/18/2000	Winter Storm	0	0
Southern Lycoming (zone)	12/13/2000	Winter Storm	0	0
Northern Lycoming (zone)	12/13/2000	Winter Storm	0	0
Southern Lycoming (zone)	12/19/2000	Heavy Snow	0	0
Northern Lycoming (zone)	12/19/2000	Heavy Snow	0	0
Northern Lycoming (zone)	3/4/2001	Heavy Snow	0	$4,000
Southern Lycoming (zone)	3/4/2001	Heavy Snow	0	$4,000
Southern Lycoming (zone)	1/6/2002	Heavy Snow	0	0
Northern Lycoming (zone)	1/6/2002	Heavy Snow	0	0
Southern Lycoming (zone)	12/5/2002	Heavy Snow	0	0
Northern Lycoming (zone)	12/5/2002	Heavy Snow	0	0
Northern Lycoming (zone)	12/10/2002	Ice Storm	0	0
Southern Lycoming (zone)	12/10/2002	Ice Storm	0	0
Northern Lycoming (zone)	12/25/2002	Heavy Snow	0	0
Southern Lycoming (zone)	12/25/2002	Heavy Snow	0	0
Southern Lycoming (zone)	1/1/2003	Ice Storm	0	0
Northern Lycoming (zone)	1/1/2003	Ice Storm	0	0
Southern Lycoming (zone)	1/2/2003	Heavy Snow	0	0
Northern Lycoming (zone)	1/2/2003	Heavy Snow	0	0
Northern Lycoming (zone)	2/16/2003	Heavy Snow	0	0
Southern Lycoming (zone)	2/16/2003	Heavy Snow	0	0
Southern Lycoming (zone)	12/14/2003	Heavy Snow	0	0
Northern Lycoming (zone)	12/14/2003	Heavy Snow	0	0
Southern Lycoming (zone)	1/27/2004	Heavy Snow	0	0
Northern Lycoming (zone)	2/3/2004	Heavy Snow	0	0
Southern Lycoming (zone)	2/3/2004	Heavy Snow	0	0
Southern Lycoming (zone)	3/16/2004	Heavy Snow	0	0
Northern Lycoming (zone)	3/16/2004	Heavy Snow	0	0
Northern Lycoming (zone)	1/5/2005	Winter Storm	0	0

Table 4.3.9-1 **Previous winter storms events in Lycoming County from 1996-2014 (NCDC, 2014).**

LOCATION	DATE	TYPE	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Southern Lycoming (zone)	1/5/2005	Winter Storm	0	0
Northern Lycoming (zone)	1/8/2005	Ice Storm	0	0
Northern Lycoming (zone)	1/22/2005	Winter Storm	0	0
Northern Lycoming (zone)	2/21/2005	Winter Storm	0	0
Southern Lycoming (zone)	3/1/2005	Heavy Snow	0	0
Northern Lycoming (zone)	3/1/2005	Heavy Snow	0	0
Northern Lycoming (zone)	10/25/2005	Heavy Snow	0	0
Northern Lycoming (zone)	12/9/2005	Heavy Snow	0	0
Southern Lycoming (zone)	12/9/2005	Heavy Snow	0	0
Southern Lycoming (zone)	12/16/2005	Winter Storm	0	0
Northern Lycoming (zone)	12/16/2005	Winter Storm	0	0
Southern Lycoming (zone)	2/13/2007	Winter Storm	0	0
Northern Lycoming (zone)	2/13/2007	Heavy Snow	0	0
Northern Lycoming (zone)	3/16/2007	Heavy Snow	0	0
Southern Lycoming (zone)	3/16/2007	Heavy Snow	0	0
Northern Lycoming (zone)	4/15/2007	Heavy Snow	0	0
Northern Lycoming (zone)	12/2/2007	Ice Storm	0	0
Northern Lycoming (zone)	12/9/2007	Ice Storm	0	0
Northern Lycoming (zone)	12/13/2007	Winter Storm	0	0
Northern Lycoming (zone)	2/1/2008	Winter Storm	0	0
Southern Lycoming (zone)	2/1/2008	Winter Storm	0	0
Southern Lycoming (zone)	2/12/2008	Ice Storm	0	0
Northern Lycoming (zone)	12/11/2008	Winter Storm	0	0
Southern Lycoming (zone)	12/19/2008	Winter Storm	0	0
Northern Lycoming (zone)	12/19/2008	Winter Storm	0	0
Southern Lycoming (zone)	12/23/2008	Ice Storm	0	0
Northern Lycoming (zone)	12/23/2008	Ice Storm	0	0
Northern Lycoming (zone)	1/6/2009	Ice Storm	0	0
Southern Lycoming (zone)	1/6/2009	Ice Storm	0	0
Northern Lycoming (zone)	1/10/2009	Winter Storm	0	0
Southern Lycoming (zone)	1/27/2009	Winter Storm	0	0
Northern Lycoming (zone)	1/27/2009	Winter Storm	0	0
Northern Lycoming (zone)	10/15/2009	Winter Storm	0	0

Table 4.3.9-1 **Previous winter storms events in Lycoming County from 1996-2014 (NCDC, 2014).**

LOCATION	DATE	TYPE	DEATHS/ INJURIES	PROPERTY DAMAGE ($)
Southern Lycoming (zone)	2/9/2010	Winter Storm	0	0
Northern Lycoming (zone)	2/25/2010	Winter Storm	0	0
Northern Lycoming (zone)	2/1/2011	Winter Storm	0	0
Northern Lycoming (zone)	2/20/2011	Heavy Snow	0	0
Southern Lycoming (zone)	2/20/2011	Heavy Snow	0	0
Northern Lycoming (zone)	3/6/2011	Heavy Snow	0	0
Southern Lycoming (zone)	3/6/2011	Heavy Snow	0	0
Northern Lycoming (zone)	3/23/2011	Winter Storm	0	0
Southern Lycoming (zone)	10/29/2011	Heavy Snow	0	0
Southern Lycoming (zone)	12/26/2012	Winter Storm	0	0
Northern Lycoming (zone)	12/26/2012	Winter Storm	0	0
Southern Lycoming (zone)	12/14/2013	Heavy Snow	0	0
Northern Lycoming (zone)	12/14/2013	Heavy Snow	0	0
Southern Lycoming (zone)	2/4/2014	Winter Storm	0	0
Northern Lycoming (zone)	2/4/2014	Winter Storm	0	0
Southern Lycoming (zone)	2/13/2014	Heavy Snow	0	0
Northern Lycoming (zone)	2/13/2014	Heavy Snow	0	0
		TOTAL	**0**	**$8,000**

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.

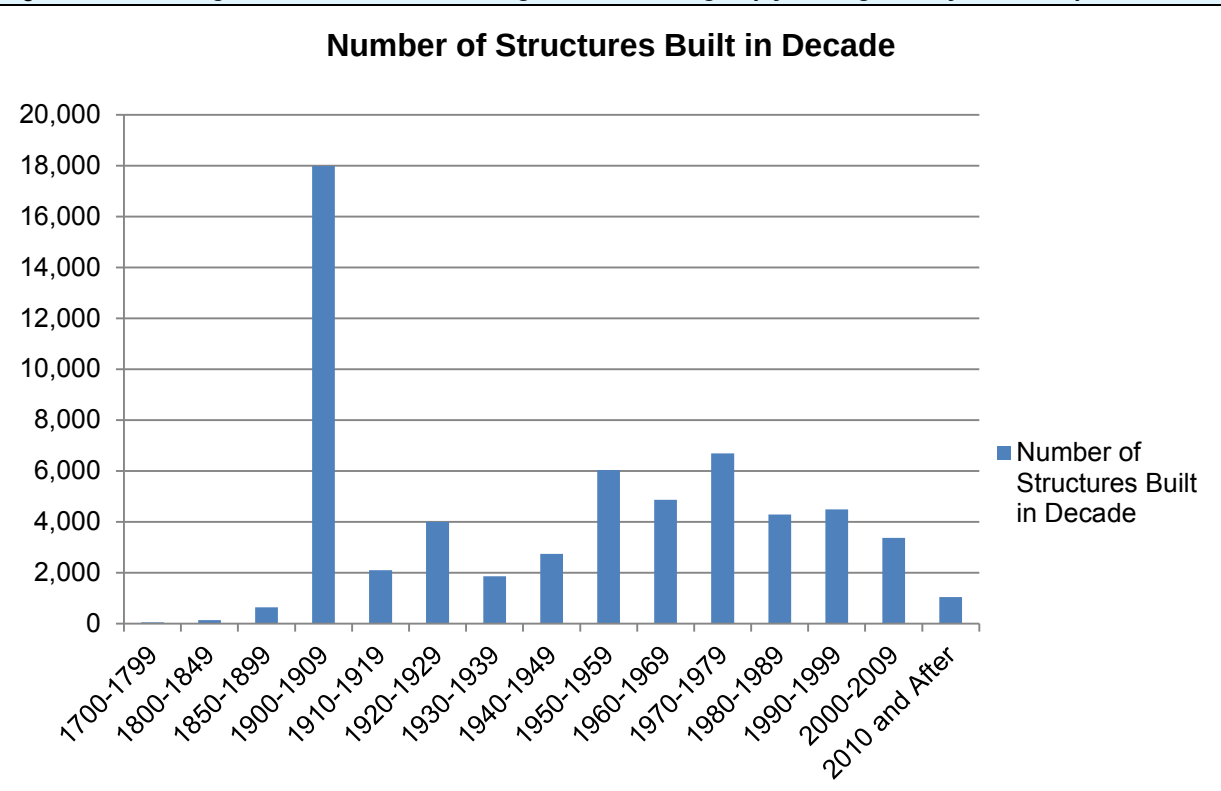
The future occurrence of climatic events cannot be predicted exactly. As noted in the table above, the County has been affected by three to eight winter storm events each year from 2004 to 2009. Given this record of reported events, it is safe for planning purposes to assume that in an average year the County can expect to experience five winter storm events. On the whole, though, the probability of future winter storm events can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.9.5. Vulnerability Assessment

In Lycoming 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 accidents, 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. All critical facilities in Lycoming County are vulnerable to winter storms. Vulnerability to the effects of winter storms on buildings is dependent on the 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 the structure has been maintained). It is assumed that older structures are more vulnerable, but additional information on construction type and building codes enforced at time of construction would allow a more thorough assessment of the vulnerability of structures to winter storm impacts such as severe wind and heavy snow loading. Figure 4.3.9-2 shows the distribution of building ages in Lycoming County; just under half of all buildings were constructed prior to 1950 in Lycoming County.

Figure 4.3.9-2 **Age of structures for buildings with known ages (Lycoming County GIS, 2014).**



Pennsylvania and Lycoming County experience several winter storms every year that can create power loss, among other obvious adverse effects. The series of storms in early 1994 and 1996 were presidentially declared disasters. Heavy snowstorm, sleet storm, ice storm, blizzard, and severe blizzard are the types of winter storms possible in Lycoming County. Due to the frequency of past events and a relatively high annual probability for high snow depths, winter storms are very likely to continue affecting normal activity in the County in the coming years.

HUMAN-MADE HAZARDS

4.3.10. Dam Failure

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

4.3.11. Disorientation

4.3.11.1. Location and Extent

Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. Search and rescue efforts are focused in and around state forest and state park lands (DCNR 2009).

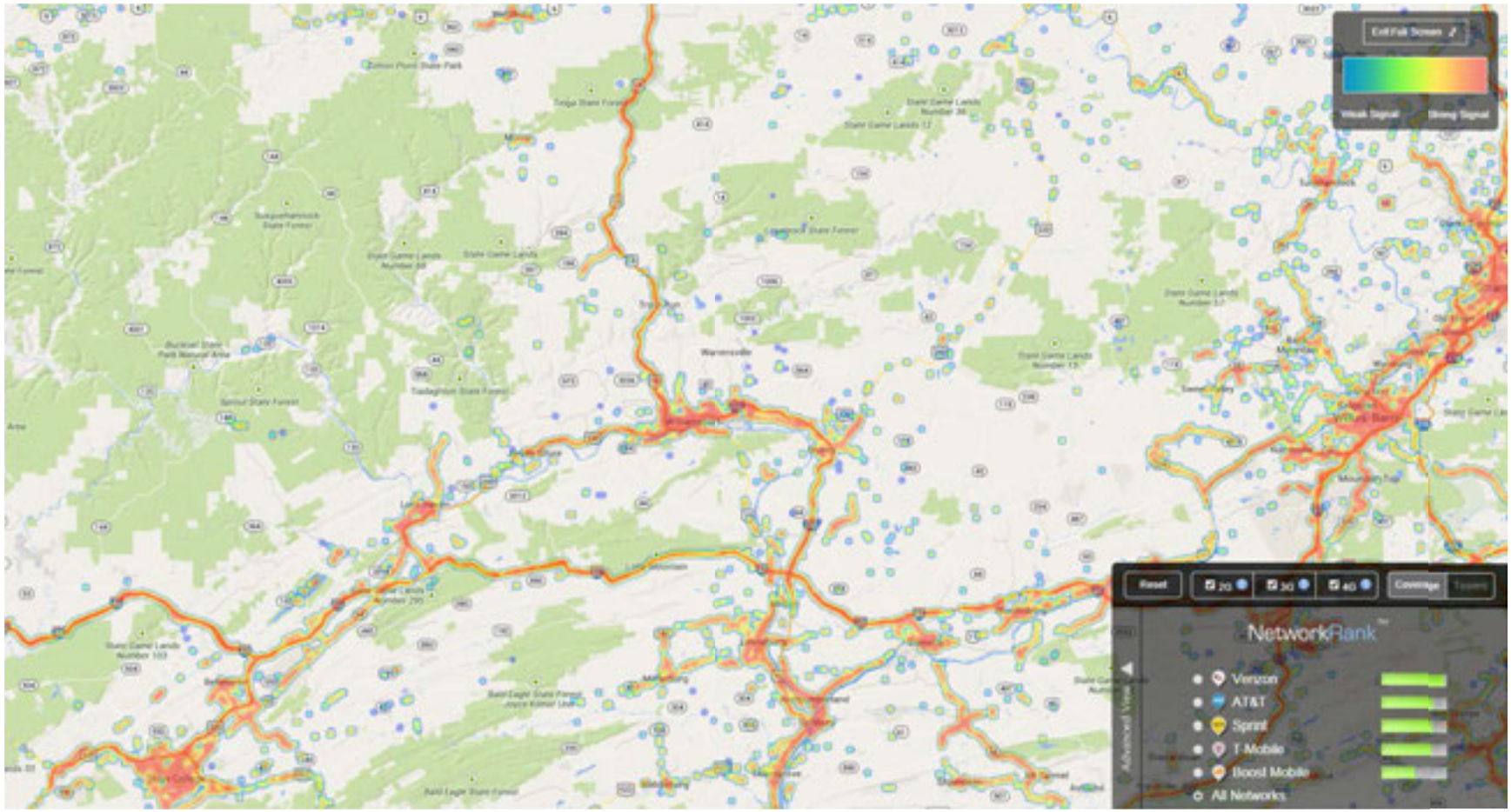
Almost a third (32% or 392 square miles) of Lycoming County is comprised of state park, state forest, and state game lands. Additionally, much of the rest of Lycoming County is wooded and underdeveloped as well, as of 2010, 77 percent of the county was forest and only 3 percent is considered urban (with agriculture and rural making the rest of the area) (Lycoming County Emergency Management Agency 2010). These large swaths of state forests and rolling terrain, make coordination across the County and cellular communication between individuals quite challenging. Disorientation is most likely to occur in areas of vast, open wilderness. With numerous trails and side, back roads in a region that is largely underserved by cellular coverage, it becomes quite easy to become lost and disoriented.

With multiple cellular networks and coverage plans available to the user, OpenSignal is a company that collects data from phone applications to identify cellular cover, signal strength, and nearby towers in relation to a phone's geographic location. According to OpenSignal, cellular reception in Lycoming County is primarily limited to Williamsport and the major roadways: U.S. Route 15, U.S. Route 220, Interstate 180 and Interstate 80. Additionally, within Lycoming, cell coverage there are just 34 cell towers (all are Verizon Wireless towers). In step with the locations of cellular coverage, these towers can also be found primarily along the major roadways. A map displaying the cellular signal in Lycoming County can be seen in Figure 4.3.11-1.

4.3.11.2. Range and Magnitude

A wide variety of factors can contribute to outcome of a search and rescue mission but the most common dangers associated with disorientation in are lack of food, water and shelter. Lycoming County generally has an abundance of water and during the warmer summer months shelter is less of a necessity than during winter months when extreme temperatures can pose a huge threat. Age, physical fitness, and familiarity with the area can also have a bearing on the outcome.

Figure 4.3.11-1 **Map from OpenSignal showing cellular signal in Lycoming County. (OpenSignal 2014).**



4.3.11.3. Past Occurrence

While search-and-rescue efforts are tracked by the DCNR, the data has not been agglomerated to a useful state for the purpose of this county level plan. However, given the numerous park lands, frequently used for recreational purposes, and sporadic cellular reception, it is expected that there have been and will continue to be lost hikers and persons over the years.

4.3.11.4. Future Occurrence

It is impossible to predict when and where disorientation may occur. During the warm summer months, as activities such as hiking, biking and camping increase, so does the likelihood of individuals becoming disoriented. Search and rescue operations throughout the County are predicted to continue but can be mitigated with appropriate actions, including improved cellular coverage and/or the installation of booster units at critical locations with weak signals. On the whole, though, the probability of future disorientation events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.11.5. Vulnerability Assessment

Individuals are most likely to become disorientated in areas of vast, open wilderness. This is especially relevant as Lycoming County's limited cellular coverage inhibits residents and visitors ability to make calls, access maps, and look up pertinent weather information, if they are anywhere outside of Williamsport and the primary road corridors. Children and the elderly are more vulnerable to the exposure of elements. The most dangerous period to become lost outdoors is during the winter months when heat and shelter are vital. Lycoming County regularly experiences winter storms and temperatures below freezing. Fortunately, most outdoor, recreational activities take place during the warmer months of spring and summer.

4.3.12. Environmental Hazards: Natural Gas Drilling Incidents

4.3.12.1. Location and Extent

There are three main types of environmental hazards: hazardous material release, mining, and natural gas drilling. Given the rapid rise of natural gas drilling in Lycoming County within the past five years, the County is primarily concerned with this industry and what risk it might pose to 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-BOGM, 2010a). Marcellus Shale natural gas extraction presents new and unique challenges and hazards in the Commonwealth. The Marcellus Shale formation is located underneath the almost the entirety of Lycoming County, which has led to an explosion of gas well drilling in the County. 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 Lycoming County exist in stray methane gas in the subsurface, which can migrate to wells and homes and ignite.

With more than 961 active natural gas drilling sites, and approximately another 350 well permits for sites that have not yet been drilled or have not materialized yet (as of July 2014) in the County, the release and combustion of a large quantity of natural gas is of particular concern, especially as this industry is in its infancy in Lycoming County. In just five years, between 2009

and 2013, 1,198 permits were issued. See Table 4.3.12-1 for a breakdown of permits issued per year, Table 4.3.12-2 shows the status of the well permits, and Table 4.3.13-3 shows the number of 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 4.3.12-1 **Number of well permits issued per year from 2006-2014 (DCNR).**

YEAR	PERMITS
2006	0
2007	12
2008	50
2009	105
2010	224
2012	306
2013	297
2014	266

Table 4.3.12-2 **Number of well per year from 2006-2014 (DCNR).**

PERMIT STATUS	NUMBER
Active	961
Plugged OG Well	41
Operator Reported Not Drilled	249
Regulatory Inactive Status	33
Proposed But Never Materialized	101

Table 4.3.12-3 **Number of well permits in Lycoming County by municipality as of July 2014 (DCNR).**

MUNICIPALITY	NO. OF PERMITS ISSUED	MUNICIPALITY	NO. OF PERMITS ISSUED
Anthony Township	11	Lycoming Township	7
Cascade Township	58	McHenry Township	84
Cogan House Township	282	McIntyre Township	47
Cummings Township	301	McNett Township	21
Eldred Township	19	Mifflin Township	34
Fairfield Township	6	Moreland Township	16
Franklin Township	53	Penn Township	110
Gamble Township	78	Pine Township	27
Hepburn Township	1	Plunketts Creek Township	2
Jackson Township	18	Shrewsbury Township	7
Jordan Township	15	Upper Fairfield Township	44
Lewis Township	107	Watson Township	37
		TOTAL	**1,385**

Figure 4.3.12-1 shows the location of the conventional gas wells and permits in Lycoming County. While, Figure 4.3.12-2 shows the location of the unconventional gas wells and permits in Lycoming County.

4.3.12.2. Range of Magnitude

Marcellus Shale play drilling has introduced a new set of hazards to the oil and gas industry in addition to the normal risks associated with natural gas extraction. The Marcellus Shale formation exists at a depth normally between 5,000 and 8,000 feet and holds trillions of cubic feet of natural gas. Extraction from this depth was previously not feasible, but as drilling technology has improved over the years, recovering natural gas from Marcellus Shale is now possible (PA DEP-BOGM, 2010a).

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

Frac fluid is extremely saline and can be three to six times as salty as sea water. Other contaminants can include barium, bromine, lithium strontium, sulfate, ammonium, and very high concentrations of total dissolved solids (TDS). There is also some concern about normally occurring radioactive materials 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;
- Mishandling of solid toxic waste.

Figure 4.3.12-1 **Conventional oil & gas well locations in Lycoming County.**

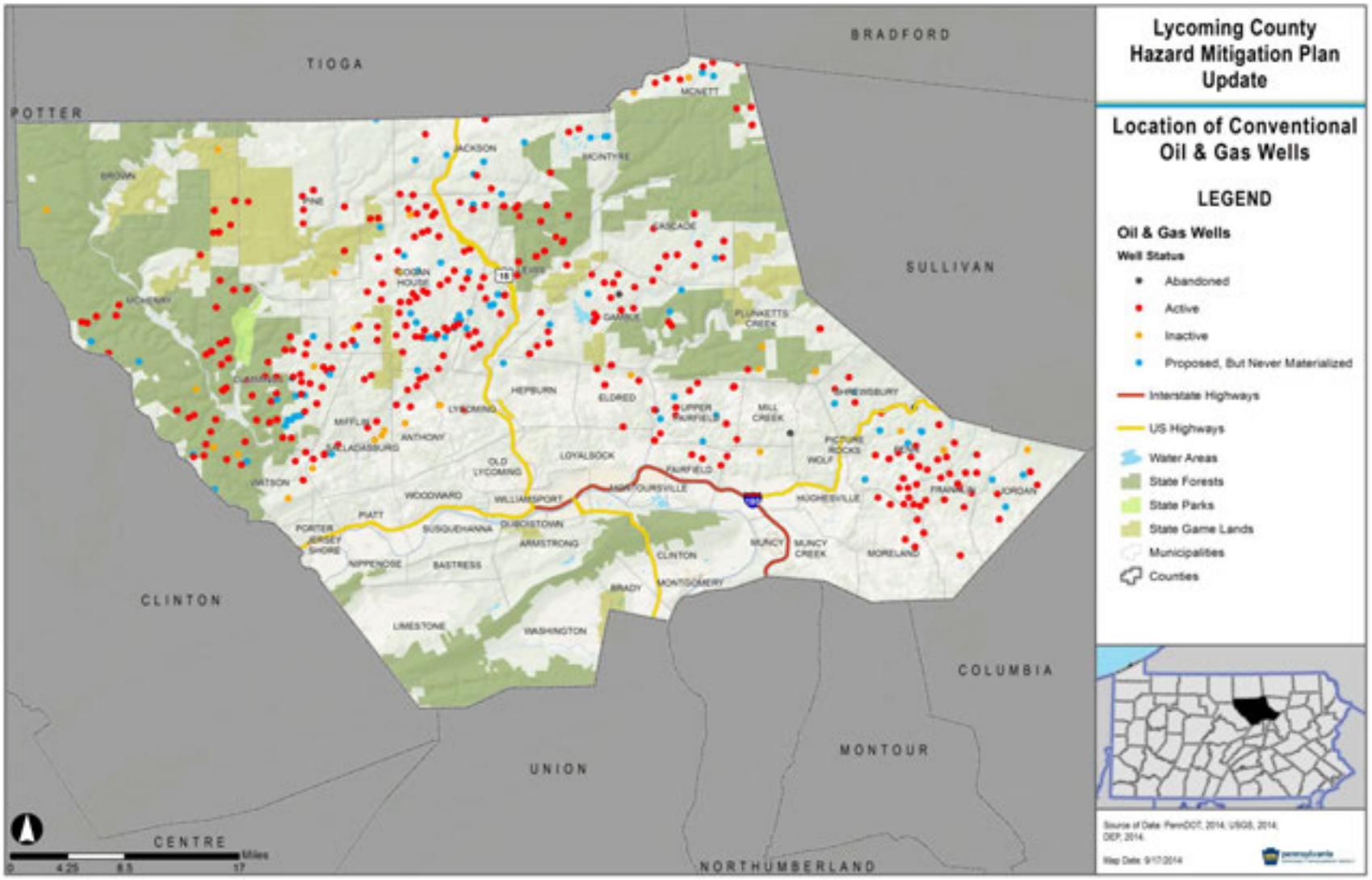
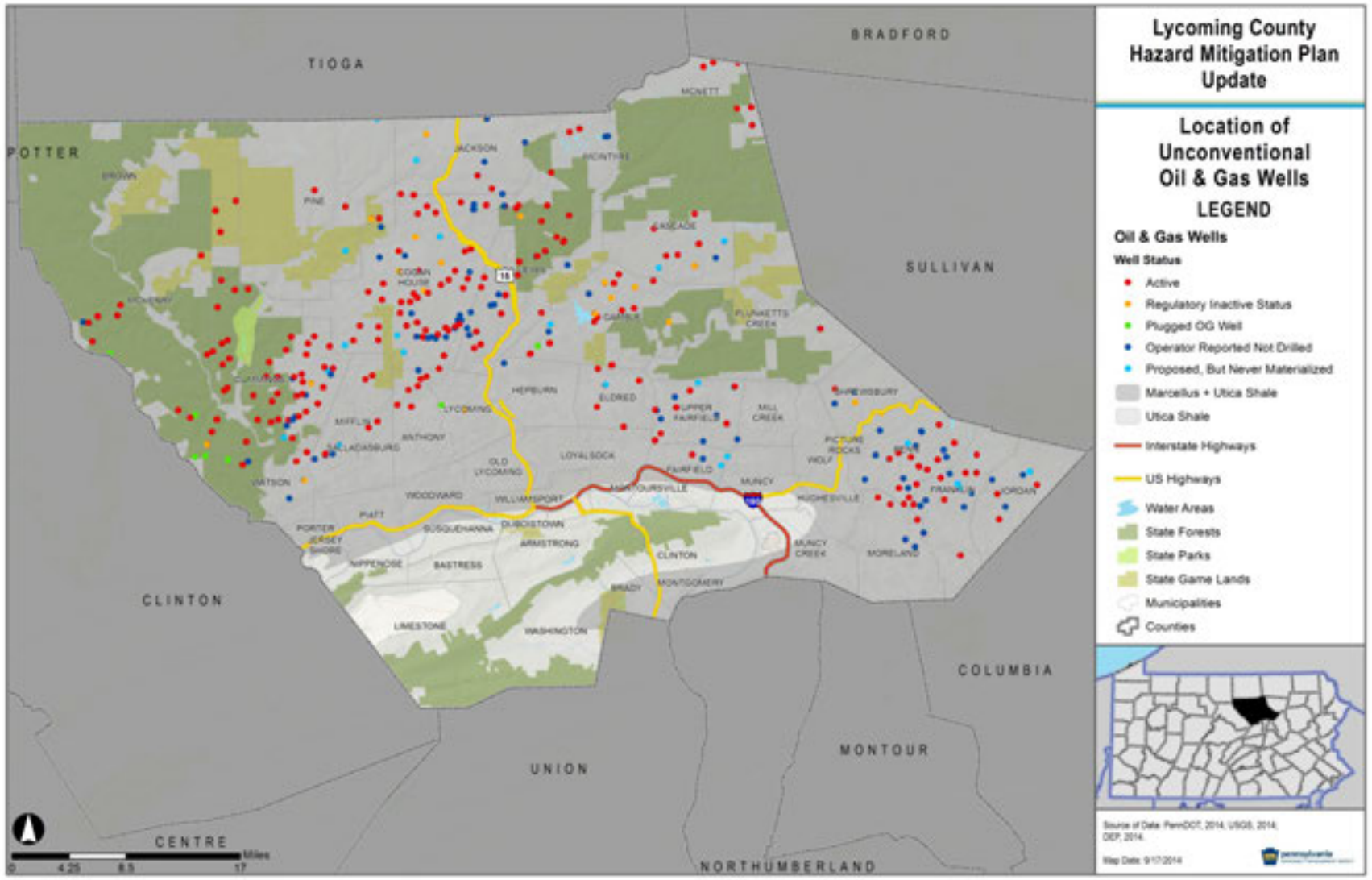


Figure 4.3.12-2 **Unconventional oil & gas well locations in Lycoming County.**



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 (e.g. building or fire codes) and maintenance failures (e.g. fire protection and containment features):** can substantially increase the damage to the facility itself and to surrounding buildings

The severity of the incident 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 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 Marcellus Shale drilling, Lycoming 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 Lycoming County as a whole and over the long-term, rather than in the case of a specific incident.

4.3.12.3. Past Occurrence

There have been few reported incidents of natural gas drilling. One incident was on July 28, 2009, a gas well in McNett Township leaked natural gas into the water table, where it spread into the Lycoming Creek, some smaller streams, and into the water supplies of four residents. No injuries or damage were reported. Aside from this leak, there have been numerous reports of both well pad permit violations and groundwater complaints. Of the 32 groundwater complaints to the PADEP, 11 have been proven to show a causality between oil and gas activity and the water complaint (the other 21 have either not been proven yet or there is no causality) (FracTracker, 2014).

4.3.12.4. Future Occurrence

The likelihood of an emergency at a natural gas drilling site in Lycoming 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 of March 2010, I-180 and US-220 are experiencing increased truck traffic due to the natural gas industry. 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.

Numerous studies have examined the ramifications (primarily the significant impact fracking has on water quality) of drilling for natural gas in a region (the entirety of the Marcellus Shale) that acts as the water supply for over 22 million (Evans and Kiesecker, 2014). The increase of natural gas drilling in Lycoming County not only implies the increased risk of an incident (that can include a chemical release, a fire, and/or an explosion), but also increased development and deforestation, both which result in 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 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 accidents.

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 accidents 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 accidents.

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 impacts 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 Lycoming County, then about 14,766 hectares (57 square miles), roughly 4% of the total area of the County, may have been disturbed by or converted to a fracking use.

The land that is affected by the natural gas industry is predominantly forested, so not only is there significant deforestation, but this deforestation means that 4% of the County has become impervious within 5 years due to the natural gas industry. If this trend continues, and the natural

gas industry continues to expand, then not only will the likelihood of a natural gas incident increase, but transportation infrastructure accidents and flooding will become greater hazards as well. 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 the County could regulate 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).

4.3.12.5. 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 4.3.12-4 enumerates the populations living within 1,000 yards of an unconventional oil and gas well. This was calculated by intersecting the 2010 Census Block centroids with the zone of culpability as defined by DEP. This analysis indicates that over half of the population of Upper Fairfield, Cogan House, and Penn Townships are most vulnerable to experiencing the impacts of an unconventional oil or gas well incident.

Table 4.3.12-4 **Populations Vulnerable to Natural Gas Drilling Incidents.**

MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
Anthony Township	865	143	16.5%
Armstrong Township	681	0	0.0%
Bastress Township	546	0	0.0%
Brady Township	521	0	0.0%
Brown Township	96	0	0.0%
Cascade Township	413	161	39.0%
Clinton Township	3,708	0	0.0%

Table 4.3.12-4 **Populations Vulnerable to Natural Gas Drilling Incidents.**

MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
Cogan House Township	955	542	56.8%
Cummings Township	273	36	13.2%
Duboistown Borough	1,205	0	0.0%
Eldred Township	2,122	813	38.3%
Fairfield Township	2,792	435	15.6%
Franklin Township	933	408	43.7%
Gamble Township	756	338	44.7%
Hepburn Township	2,762	0	0.0%
Hughesville Borough	2,128	0	0.0%
Jackson Township	396	131	33.1%
Jersey Shore Borough	4,361	0	0.0%
Jordan Township	863	182	21.1%
Lewis Township	987	159	16.1%
Limestone Township	2,019	0	0.0%
Loyalsock Township	11,026	18	0.2%
Lycoming Township	1,478	47	3.2%
McHenry Township	143	8	5.6%
McIntyre Township	520	1	0.2%
McNett Township	174	10	5.7%
Mifflin Township	1,070	73	6.8%
Mill Creek Township	604	0	0.0%
Montgomery Borough	1,579	0	0.0%
Montoursville Borough	4,615	0	0.0%
Moreland Township	943	182	19.3%
Muncy Borough	2,477	0	0.0%
Muncy Creek Township	3,474	0	0.0%
Muncy Township	1,089	3	0.3%
Nippenose Township	709	0	0.0%
Old Lycoming Township	4,938	0	0.0%

Table 4.3.12-4 **Populations Vulnerable to Natural Gas Drilling Incidents.**

MUNICIPALITY	TOTAL 2010 POPULATION	2010 POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL*	PERCENT POPULATION WITHIN 1,000 YARDS OF UNCONVENTIONAL OIL/GAS WELL
Penn Township	960	536	55.8%
Piatt Township	1,180	0	0.0%
Picture Rocks Borough	678	0	0.0%
Pine Township	294	19	6.5%
Plunketts Creek Township	684	0	0.0%
Porter Township	1,601	0	0.0%
Salladasburg Borough	238	0	0.0%
Shrewsbury Township	409	155	37.9%
South Williamsport Borough	6,379	0	0.0%
Susquehanna Township	1,000	0	0.0%
Upper Fairfield Township	1,823	1,052	57.7%
Washington Township	1,619	0	0.0%
Watson Township	537	135	25.1%
Williamsport City	29,381	0	0.0%
Wolf Township	2,907	0	0.0%
Woodward Township	2,200	0	0.0%
TOTAL	**116,111**	**5,587**	**4.8%**

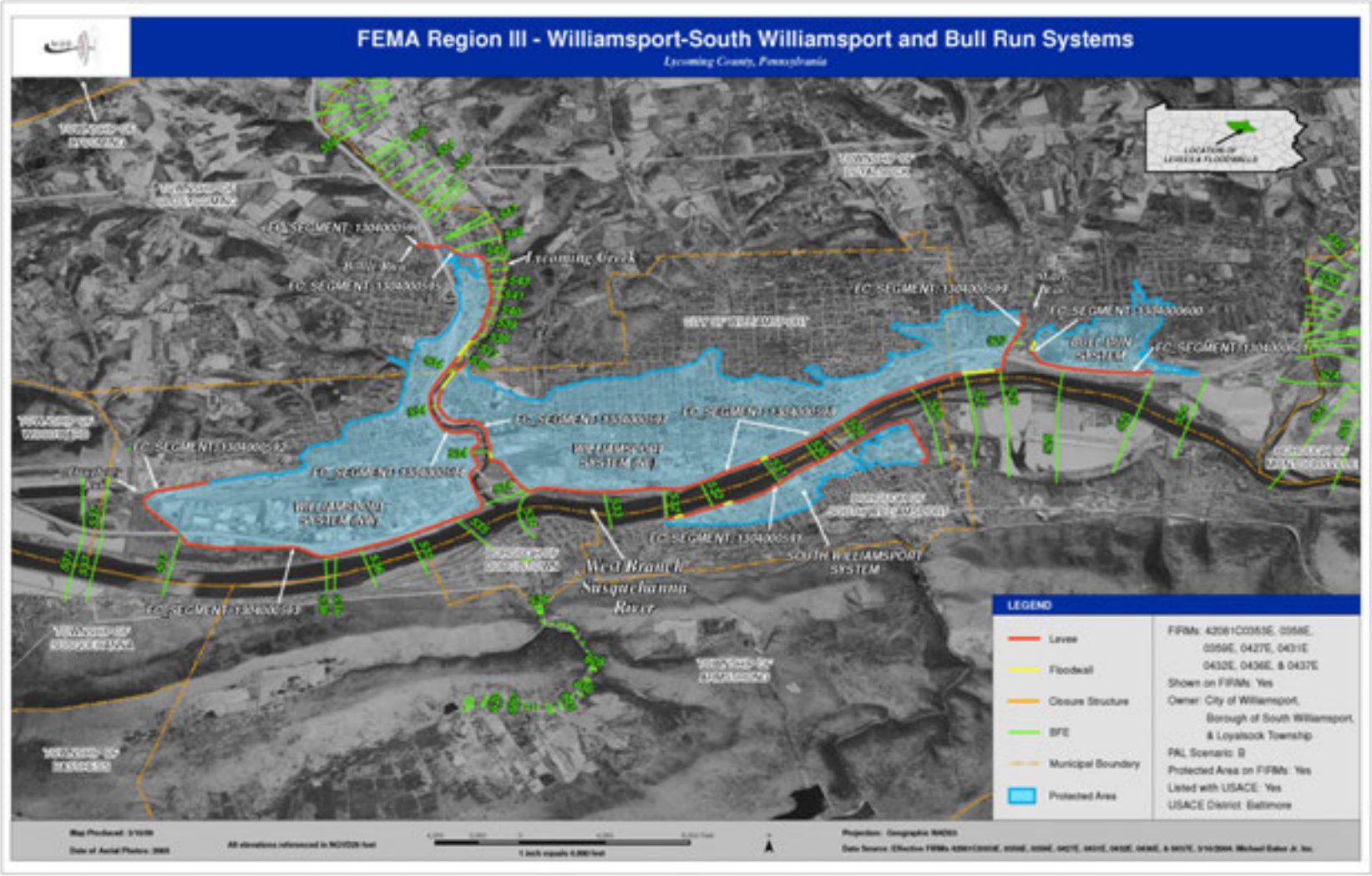
4.3.13. Levee Failure

4.3.13.1. Location and Extent

FEMA completed an inventory of all known levees across Pennsylvania in 2009, known as the Mid-Term Levee Inventory (MLI). The MLI contains levee data gathered first and foremost for structures designed to protect from the 1 percent-annual-chance flood event. The area behind a maintained and certified levee that is designed to protect from a 1 percent-annual-chance flood is called a Levee Protected Area. The MLI also frequently includes levees that were not designed to protect against this base flood, but the MLI does not include every levee in every county – especially small levees and agricultural levees not engineered or able to be accredited to the 1 percent-annual-chance event. FEMA's inventory was compiled using all effective Flood Insurance Rate Maps and Flood Insurance Study reports in Pennsylvania, the USACE levee inventory, the DEP's Flood Control Project summaries, information from local governments, aerial photography, and additional information such as news articles and websites.

As described in Section 4.3.3, there are four levee systems within Lycoming County: Williamsport (NE) Levee System, Williamsport (NW) Levee System, South Williamsport Levee System, and Bull Run Flood Protection System. These levees are located along the Susquehanna River and provide protection to the neighboring communities from flooding. The Northeast Williamsport Levee Systems protects the City of Williamsport and a portion of Loyalsock Township while the Northwest protects the City of Williamsport and a portion of Old Lycoming Township. The South Williamsport Levee System protects South Williamsport Borough. Loyalsock Township is also protected by the Bull Run Flood Protection System. Figure 4.3.13-1 shows the levee systems and the protected areas.

Figure 4.3.13-1 **Levee systems in Lycoming County along the West Branch Susquehanna River .**



4.3.13.2. Range of Magnitude

A levee failure or breach causes flooding in landward areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating depending on the level of flooding for which the structure is designed and the amount of landward development present. The environmental impacts of a levee failure result in significant water quality and debris disposal issues. Flood waters will back up sanitary sewer systems and inundate waste water treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooding waterway. The contents of unsecured containers of oil, fertilizers, pesticides and other chemicals get added to flood waters. Water supplies and waste water treatment could be off-line for weeks. After the flood waters subside, contaminated and flood damaged building materials and contents must be properly disposed. Contaminated sediment must be removed from buildings, yards and properties. The potential for these worst case impacts to occur in Lycoming County, particularly the communities of the City of Williamsport, Old Lycoming Township, Loyalstock Township, and South Williamsport Borough is possible since there are significant levee systems located within the central portion of the County.

4.3.13.3. Past Occurrence

There are no known previous levee failures in Lycoming County, and the current levee system does provide significant protection from the 1%-annual-chance flood.

4.3.13.4. Future Occurrence

Similarly to dam failures, given certain circumstances, levee failures can occur at any time. However, the probability of future occurrence can be reduced through proper design, construction and maintenance measures. Most levees are designed to meet a specified level of flooding. While FEMA focuses on mapping levees that will reduce the risk of a 1 percent-annual-chance flood, other levees may be designed to protect against smaller or larger floods. Design specifications provide information on the percent-annual-chance flood a structure is expected to withstand, provided that it has been adequately constructed and maintained. Overall, the probability of future levee failures can be considered *unlikely* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.13.5. Vulnerability Assessment

Communities that are particularly vulnerable to levee failure in Lycoming County are the City of Williamsport, Old Lycoming Township, Loyalstock Township, and South Williamsport Borough. This is due to the fact that these communities directly abut the levee systems in the county, which are of significant size and could create significant losses if they were to fail. If levee failure occurred across both systems, a total of 8,346 structures (115 of which are critical facilities) would be at risk from being inundated or destroyed by the Western Branch of the Susquehanna River.

While unlikely, it is also possible that structures would be flooded due to a failure of the levee systems in Lycoming County. The levee systems provide 1%-annual-chance protection, but in the event of a levee failure, the structures and critical facilities behind the levees would be subject to potentially high-velocity and high-volume flow. Table 4.3.13-1 shows the structures and critical facilities protected by levees and Table 4.3.13-2 provides information regarding the

property type of the structures within the SFHA. The flood protection system covers Loyalsock Township, Old Lycoming Township, South Williamsport Borough, and the City of Williamsport.

Table 4.3.13-1 **Structures and Critical Facilities Vulnerable to Levee Failure.**

Municipality	Total Structures in Municipality	Structures in Levee Protected Area	Percent of Structures in Levee Protected Area	Total Critical Facilities in Municipality	Total Critical Facilities in Levee Protected Area	Percent Critical Facilities in Levee Protected Area
Loyalsock Township	5,344	649	12.1%	54	4	7.4%
Old Lycoming Township	3,091	315	10.2%	22	7	31.8%
South Williamsport Borough	2,899	716	24.7%	28	13	46.4%
City of Williamsport	12,248	6,666	54.4%	129	91	70.5%
TOTAL	63,791	8,346	13.1%	675	115	17.0%

Table 4.3.13-2 **Structures in levee protected areas by generalized property type.**

Municipality	Total Structures	Agri-cultural	Com-mercial	Industrial	Resi-dential	Transport ation/ Utilities	Un-known	Grand Total
Loyalsock Township	5,344	0	232	13	399	2	3	649
Old Lycoming Township	3,091	0	147	6	154	0	8	315
South Williamsport Borough	2,899	0	154	19	531	3	9	716
Williamsport City	12,248	1	1,744	136	4,685	14	86	6,666
TOTAL	63,791	1	2,277	174	5,769	19	106	8,346

4.3.14. Nuclear Incident

4.3.14.1. Location and Extent

Following the accident at the Three Mile Island Nuclear Generating Station in 1979, the Nuclear Regulatory Commission (NRC) reexamined the role of emergency planning for protection of the public in the vicinity of nuclear power plants. The NRC issued regulations requiring that before a plant could be licensed to operate, the NRC must have “reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.” The regulations set forth 16 emergency planning standards and define the responsibilities of the

licensee, and the state and local organizations involved in emergency response. The added feature of emergency planning to the NRC's "defense-in-depth" philosophy provides that, even in the unlikely event of a release of radioactive materials to the environment, there is reasonable assurance that actions can be taken to protect the population around nuclear power plants.

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

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

Portions of Lycoming County are within the Ingestion Exposure Pathway Emergency Planning Zone (EPZ) (within 50 miles) of the Susquehanna Steam Electric Station (SSES) in Luzerne County. The other four nuclear plants in Pennsylvania are more than 50 miles away from Lycoming County; this distance exceeds the Plume Exposure and Ingestion Exposure Pathway EPZs for radiological emergencies, so these other facilities are considered a minimal threat to the County. Figure 4.3.14-1 illustrates the location of the nuclear facilities in the Commonwealth and their associated plume and ingestion areas.

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

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

4.3.14.2. Range of Magnitude

The Susquehanna Steam Electric Station (SSES) is the closest nuclear facility to Lycoming County. Parts of Lycoming County, including the City of Williamsport, fall within the "ingestion exposure pathway," which is the 50-mile radius around a plant that may receive some contamination in very small amounts in the event of a radioactive release. Thousands of County residents reside within this zone. It is a remote possibility that Lycoming County could suffer the effects of radiological contamination as a result of being located within the 50-mile ingestion exposure pathway. In the event of a release, national-level repercussions may produce anti-nuclear activism, widespread concern over public health, and a moratorium on new or renewed nuclear facilities around the nation.

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

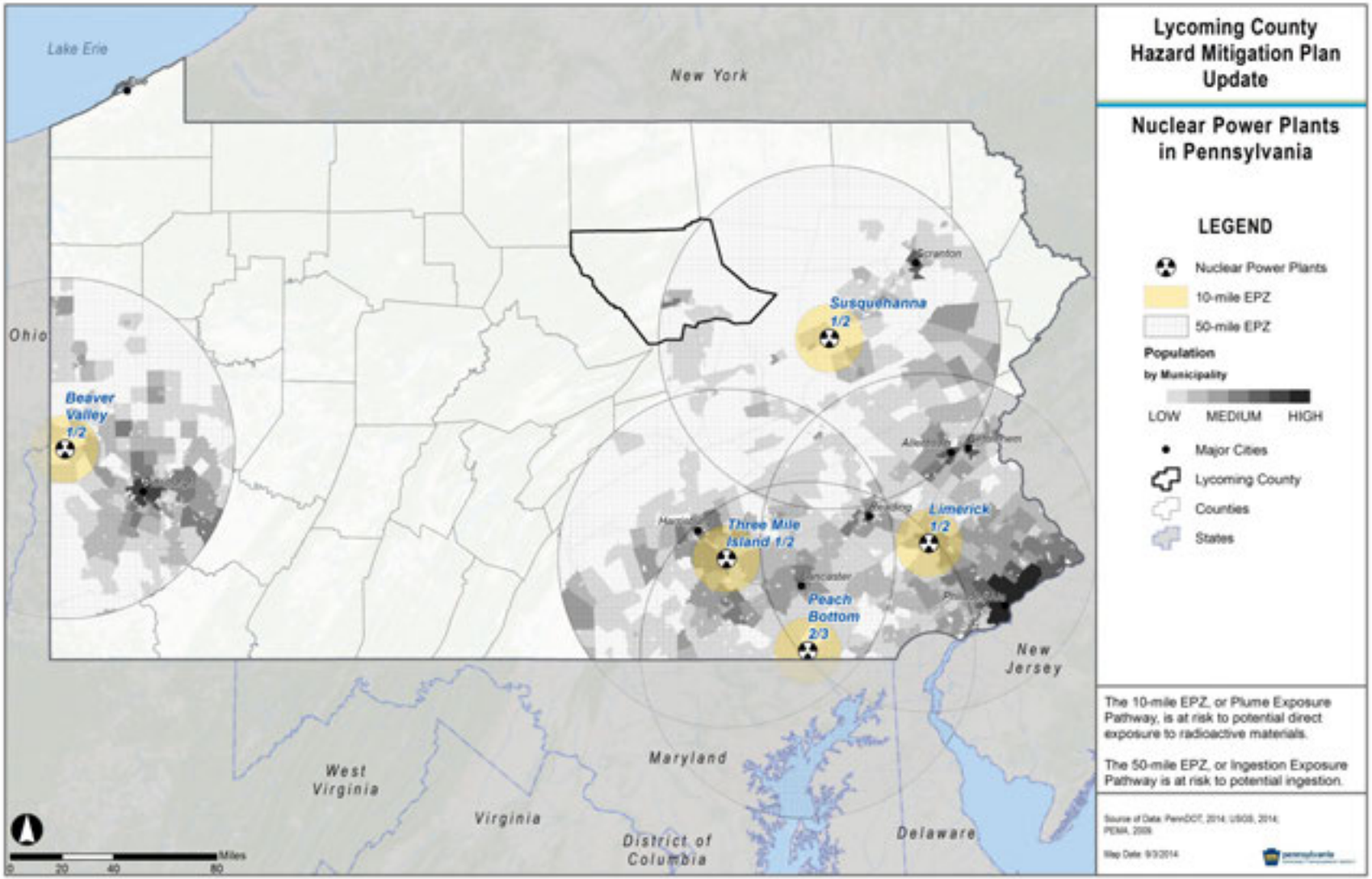
Nuclear accidents themselves are classified into three categories:

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

Nuclear facilities must notify the appropriate authorities in the event of an accident. The Nuclear Regulatory Commission uses four classification levels for nuclear incidents (Nuclear Regulatory Commission, 2008):

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

Figure 4.3.14-1 **Location of Lycoming County in relation to Pennsylvania nuclear power stations, their Emergency Planning Zones (EPZs), and the population density of affected municipalities (PEMA, 2009 and Census, 2014).**



- **Alert:** If an alert is declared, events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guides (PAGs).
- **Site Area Emergency:** A site area emergency involves events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA PAGs except near the site boundary.
- **General Emergency:** A general emergency involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs for more than the immediate site area.

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

4.3.14.3. Past Occurrence

Pennsylvania is home to the worst nuclear facility accident in the history of the nation at the Three Mile Island Nuclear Generating Station (TMI). As the only nuclear facility to reach the General Emergency ECL, its indirect effects were felt nationwide- after the accident at TMI, state, county, and municipal entities designed plans for handling future accidents so that safety could be ensured for all residents. The incident had no direct impact on Lycoming County.

4.3.14.4. Future Occurrence

Pennsylvania is home to the only nuclear power plant *General Emergency* in the nation. Since the Three Mile Island incident, nuclear power has become significantly safer and is one of the most heavily regulated industries in the nation. Despite the knowledge gained since then, there is still the potential for a similar accident to occur again at one of the five nuclear generating facilities in the Commonwealth. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development notes that studies estimate the chance of protective barriers in a modern nuclear facility at less than one in 100,000 per year (Nuclear Energy Agency 2005). Nuclear incident occurrences may also occur as a result of intentional actions; these acts are addressed under Section 4.3.15: Terrorism.

The frequency of radiological accidents above the "Alert" level in the United States is extremely low, with a frequency of occurrence approximately once every 30 years or less. Likewise, the likelihood of an incident at the Susquehanna Steam Electric Station is low. On the whole, though, the probability of future nuclear incident events can be considered *unlikely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.14.5. Vulnerability Assessment

The following municipalities lie within 50 miles of the Susquehanna Steam Electric Station (SSES):

- Armstrong Township
- Bastress Township
- Brady Township
- Cascade Township
- Clinton Township
- Duboistown Borough
- Eldred Township
- Fairfield Township
- Franklin Township
- Gamble Township
- Hepburn Township
- Hughesville Borough
- Jordan Township
- Lewis Township
- Limestone Township
- Loyalsock Township
- Lycoming Township
- McIntyre Township
- McNett Township
- Mill Creek Township
- Montgomery Borough
- Montoursville Borough
- Moreland Township
- Muncy Creek Township
- Muncy Borough
- Muncy Township
- Old Lycoming Township
- Penn Township
- Picture Rocks Borough
- Plunketts Creek Township
- Shrewsbury Township
- South Williamsport Borough
- Susquehanna Township
- Upper Fairfield Township
- Washington Township
- Williamsport, City of
- Wolf Township

The effects and impacts of a radiological threat depend on the type of radiation released, the duration of the release, the volume of the release, and the existing weather conditions, such as wind speed and direction. Should a radiological incident occur, the greatest threat and highest impact would be to the health and safety of the citizens of Lycoming County. Structural damage or damage to critical facilities is not expected, especially within the 50-mile EPZ of a nuclear facility. Instead, contamination is the concern. The health of the citizens in the surrounding area is the primary, immediate concern; the next concern is the long-term impact on the environment. Livestock, livestock by-products, and crops can be contaminated for many years after a nuclear incident. As a result, some or all of Lycoming County's $72.2 million in agricultural products, which includes crops and livestock, would be at risk during a nuclear incident.

The health effects reported from the psychological stress of individuals living in the immediate area will strain stress management and disaster psychology resources to the limit. Radionuclide ingestion by domesticated farm animals could force agricultural product embargos, placing severe strain on the economy. Radiological particulate contamination of the environment could impact natural resources; disrupt service delivery; and cause work cessation and evacuations. Other response measures that result from the event could damage the local economy.

Power failure is the most common secondary effect of a nuclear incident. More serious secondary effects would include public health emergencies, resulting from widespread radionuclide ingestion.

4.3.15. Terrorism

4.3.15.1. Location and Extent

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

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

Terrorism refers to the use of weapons of mass destruction (WMD), including, biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous materials releases; and “cyber-terrorism.” Within these general categories, however, there are many variations. Particularly in the area of biological and chemical weapons, there is a wide variety of agents and ways for them to be disseminated.

Terrorism can take many forms:

- Agriterrorism,
- Arson/incendiary attack,
- Armed attack,
- Biological agent,
- Chemical agent,
- Cyberterrorism,
- Conventional bomb,
- Intentional hazardous materials or radiological releases, or
- Nuclear bombs.

The severity of terrorist incidents depends upon the type of method used, the proximity of the device to people, animals, or other assets, and the duration of exposure to the incident or device. For example, chemical agents are poisonous gases, liquids, or solids that have toxic effects on people, animals, or plants. Many chemical agents can cause serious injuries or death. Severity of injuries depends on the type and amount of the chemical agent used and the duration of exposure.

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

4.3.15.2. Range of Magnitude

Three types of terrorist activity have potential relevance to Lycoming County: agriterrorism, intentional hazardous materials releases, and bomb threats. Agriterrorism is direct, intentional, generally covert contamination of food supplies or introduction of pests and/or disease agents to crops, livestock, or forestland. Lycoming County is semi-rural with the majority of its land area dedicated to forests. The County also has a number of SARA Title III facilities and major transportation routes that traverse the County, making intentional hazardous materials release a potential threat to citizens and the environment. Bomb threats represent a simple way to disrupt activities at critical infrastructure facilities, major events, financial institutions, and schools.

Lycoming County has a long, storied history with the Little League World Series (LLWS) making it an inviting terrorist target. Despite no reported incidents of terrorism in this County, these events can occur in any location. The LLWS is a well-attended and publicized event with a single game attendance record of 45,000 spectators. A terrorist attack, such as the detonation of a vehicle-borne improvised explosive device, may cause hundreds and/or thousands of injuries and/or deaths. First responder services (such as EMS, fire, and police) may be delayed for an indefinite period of time due to ingress and egress challenges, resource availability and capabilities, emergency response coordination, and communication challenges. The willingness of terrorists to attack a family-oriented event will cause worldwide psychosocial and political ramifications. Lycoming County will suffer long-term economic consequences due to decreased attendance. Annually, the LLWS injects nearly $20 million in revenue into the local economy. The hospitality industry – lodging, restaurants, transportation, and fuel services – will experience negative economic effects resulting from a terror event.

4.3.15.3. Past Occurrence

The only terrorist events experienced by Lycoming County were bomb threats. In 2001, one terrorist incident (i.e., bomb threat) was reported to PEMA. In 2002, five were reported. Since then, there were no bomb threats reported in 2003, four in 2004, five in 2005, one in 2006, four in 2007, and two in 2008.

4.3.15.4. Future Occurrence

The probability of terrorism occurring cannot be quantified with as great a level of accuracy as that of many natural hazards. Furthermore, these incidents generally occur at a specific location, such as a government building, rather than encompassing an area such as a floodplain. Thus, planning should be asset-specific, identifying potentially at-risk critical facilities and systems in the community. Once a comprehensive list of critical assets has been developed, it should be prioritized so that efforts can be directed to protect the most important assets first. Then, beginning with the highest-priority assets, the vulnerabilities of each facility or system to each type of hazard should be assessed.

For the purpose of developing a realistic prioritization of terrorism hazard mitigation projects, three elements should be considered in concert:

- Relative importance of the various facilities and systems in the asset inventory
- Vulnerabilities of those facilities
- Threats that are known to exist

Critical assets and infrastructures are systems whose incapacity or destruction would have a debilitating effect on the county:

- Government services
- Emergency services
- Water supply systems
- Transportation networks
- Telecommunications infrastructure
- Electrical power systems
- Gas and oil facilities

Lycoming County has many notable local landmarks and one major landmark of national significance: the site of the Little League World Series. The site has international significance, notably to children involved in Little League. In 2003, over 330,000 people visited the site during the 10-day Little League World Series. The symbolism of the site and the vulnerability of its users make it a possible target for future terrorist activity. Each year, federal, state, and local law enforcement and intelligence agencies collaborate to ensure that the site remains safe from terrorist attacks.

Additionally, the burgeoning Marcellus Shale natural gas drilling industry includes many gas well sites within Lycoming County. Any of these sites could be a potential target for terrorism, especially by groups opposing the petroleum industry or natural conservation groups (e.g., the Earth Liberation Front, or ELF). On the whole, though, the probability of future terrorism events can be considered *unlikely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.15.5. Vulnerability Assessment

With the exception of the Little League World Series site and Marcellus Shale gas drilling sites described above, Lycoming County does not have facilities, buildings, or landmarks of national importance that are more likely to be terrorism targets than other areas in the United States.

Notable County landmarks are of a local historical interest. Of greater concern to the community may be agriterrorism and intentional hazardous material releases. Intentional hazardous material releases are possible at the SARA Title III facilities found throughout the County and along the major transportation routes that traverse the County. These releases would affect population centers as well as water supply areas.

All critical infrastructure is vulnerable to acts of terrorism, especially those acts committed by local groups that know the communities' dependence on that infrastructure. Each critical facility must be individually assessed for its vulnerability to a terrorist or criminal event. The following checklist provides guidance on areas for examination in determining a facility's vulnerability to attack

- **Inherent vulnerability:**
  - Visibility – How aware is the public of the existence of the facility?
  - Utility – How valuable might the place be in meeting the objectives of a potential terrorist?
  - Accessibility – How accessible is the place to the public?
  - Asset mobility – is the asset's location fixed or mobile?
  - Presence of hazardous materials – Are flammable, explosive, biological, chemical and/or radiological materials present on site? If so, are they well secured?
  - Potential for collateral damage – What are the potential consequences for the surrounding area if the asset is attacked or damaged?
  - Occupancy – What is the potential for mass casualties based on the maximum number of individuals on site at a given time?
- **Tactical vulnerability:**

  Site Perimeter
  - Site planning and Landscape Design – Is the facility designed with security in mind – both site-specific and with regard to adjacent land uses?
  - Parking Security – Are vehicle access and parking managed in a way that separates vehicles and structures?

  Building Envelope
  - Structural Engineering – Is the building's envelope designed to be blast-resistant? Does it provide collective protection against chemical, biological and radiological contaminants?

  Facility Interior
  - Architectural and Interior Space Planning – Does security screening cover all public and private areas?
  - Mechanical Engineering – Are utilities and Heating, Ventilating and Air Conditioning (HVAC) systems protected and/or backed up with redundant systems?
  - Electrical Engineering – Are emergency power and telecommunications available? Are alarm systems operational? Is lightning sufficient?
  - Fire Protection Engineering – Are the building's water supply and fire suppression systems adequate, code-compliant and protected? Are on-site personnel trained appropriately? Are local first responders aware of the nature of the operations at the facility?

- Electronic and Organized Security – Are systems and personnel in place to monitor and protect the facility?

4.3.16. Transportation Accident

4.3.16.1. Location and Extent

Several major corridors run through Lycoming County, making it susceptible to traffic and roadway hazards. U.S. Route 15 runs north/south, bisecting the County in the middle. Duboistown, South Williamsport, and Williamsport make up the area where three major roadways intersect: Interstate 180, U.S. Route 15, and U.S. Route 220. U.S. Route 15, which runs north/south from South Carolina into New York, is a major transportation corridor on the East Coast of the United States. Because of this, many commercial vehicles pass through the County on a daily basis. Lycoming County's transportation network is illustrated in Figure 4.3.16-1.

Lycoming County, as a whole, is at high risk for traffic accidents of all degrees. Being an educational epicenter, home to several higher educational facilities makes the annual influx of drivers a fluid number rather than a fixed statistic. The Williamsport area has many attractions that also bring an influx of drivers, beyond the normal day-to-day numbers. The Little League World Series and Hall of Fame bring in varying annual numbers of visitors from around the world. Figure 4.3.16-2 displays the traffic volume on state roads in Lycoming County.

Figure 4.3.16-1 **Lycoming County's transportation network, including highways, rail, and aviation.**

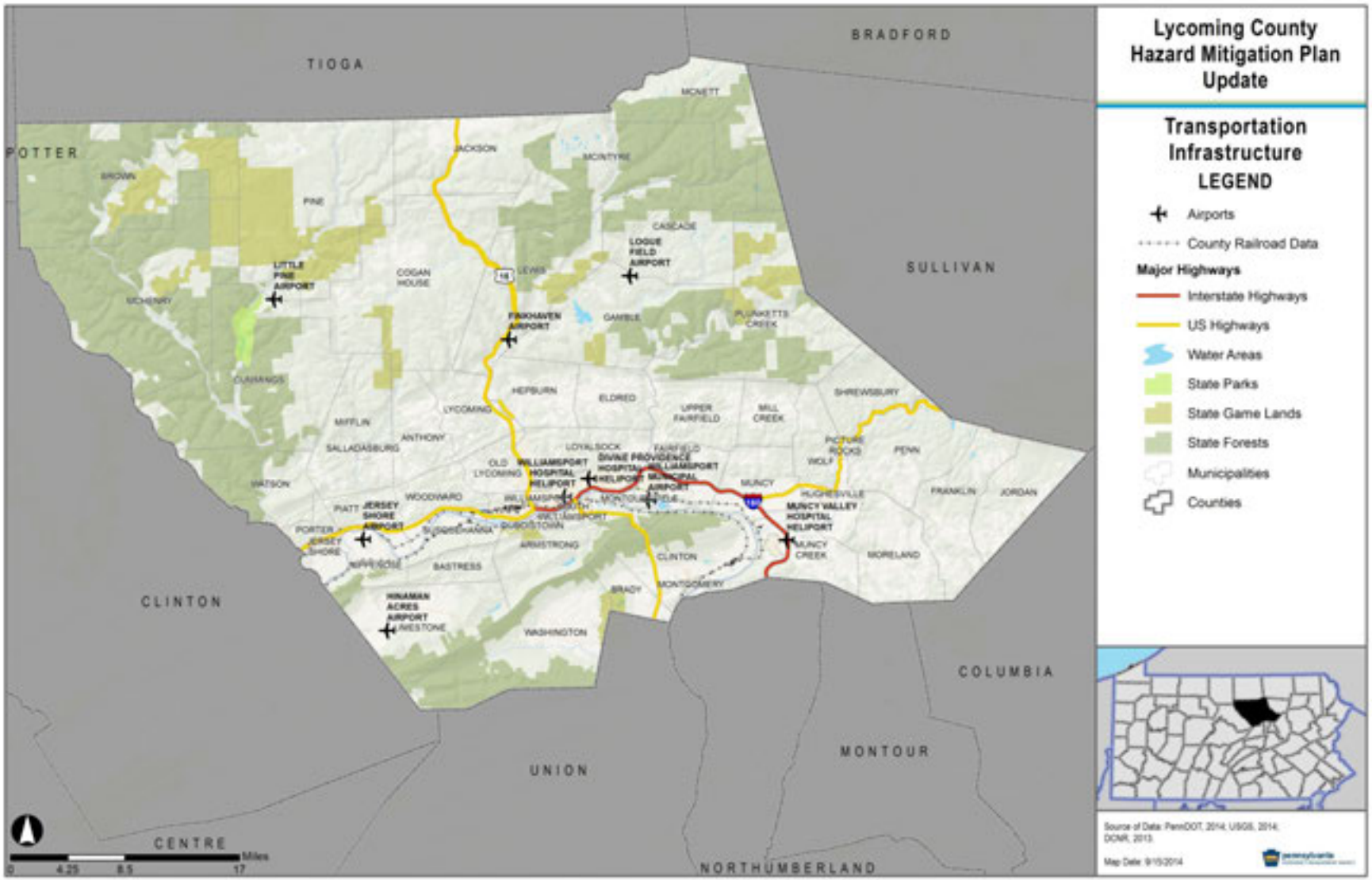
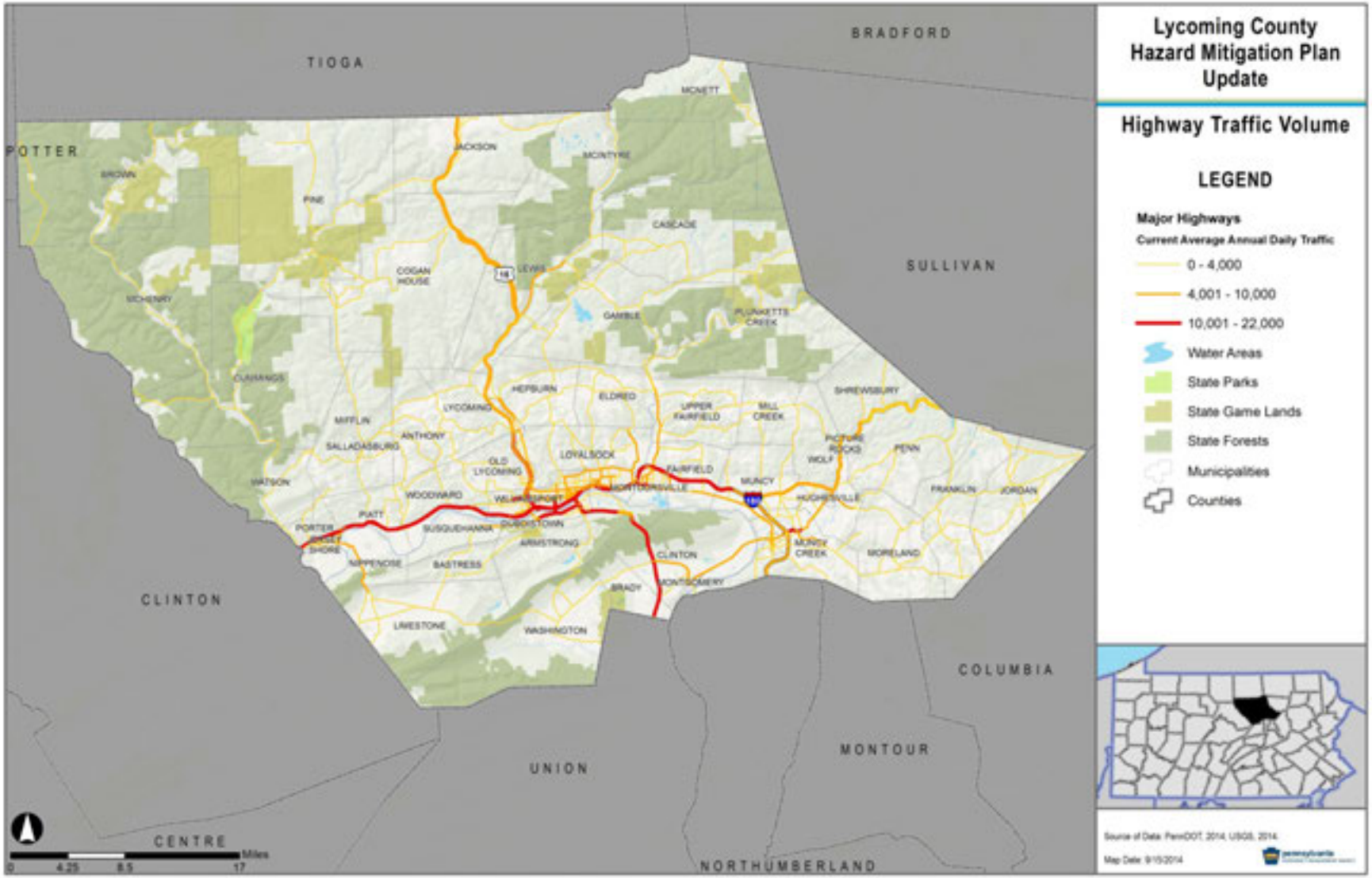


Figure 4.3.16-2 **Traffic volume on state roads in Lycoming County.**



4.3.16.2. Range of Magnitude

Traffic accidents are measured two ways. First, insurance companies look at the level of damage sustained to the vehicle. They identify them as undamaged, damage has occurred that is cost effective to repair, or the vehicle is considered a complete loss, as it would cost more to fix than it is currently worth. Secondly, deaths or injuries that have occurred as a result of the event must be considered. For the purpose of this community-oriented analysis, consideration of what damage has occurred to the motor vehicle is not included. Secondary impacts such as environmental damage or property damage other than the automobiles involved are included, because these types of problems will involve the community and may require a wider community response.

Lycoming County is a hub of many major transportation routes and Williamsport has become a base of intermodal transportation in the region. In the city, over 27,000 vehicles traverse the Market Street Bridge on a daily basis. An accident involving multiple vehicles would impact the local transportation infrastructure, as well as the freight and manufacturing industry, and will force road closures for an undetermined period of time. A large number of casualties should be anticipated by emergency responders. Upon notification of a multi-vehicle accident (particularly when entrapment is reported), county hospitals should enact their medical surge capacity plans. During the road closure, vehicular traffic will be rerouted through secondary streets, increasing local traffic in the area.

4.3.16.3. Past Occurrence

Though the number of crashes in Lycoming County has only started to decrease since 2011, there has been a steady decrease in the number of fatalities and injuries as a result of crashes since 2009. Table 4.3.16-1 shows PennDOT data on traffic crashes from 2003 to 2013.

Table 4.3.16-1 **Total number of crashes, fatal crashes, and property damage-only crashes in Lycoming County (PennDOT, 2014).**

YEAR	TOTAL CRASHES	TOTAL FATAL CRASHES	TOTAL INJURY CRASHES	TOTAL PROPERTY DAMAGE-ONLY CRASHES
2003	1,271	13	580	678
2004	1,255	24	576	655
2005	1,148	17	561	570
2006	1,085	16	555	514
2007	1,313	20	627	666
2008	1,244	12	570	662
2009	1,162	15	554	593
2010	1,226	20	574	632
2011	1,324	19	619	686
2012	1,248	15	592	641
2013	1,187	9	496	682
TOTAL	**13,463**	**180**	**6,304**	**6,979**

4.3.16.4. Future Occurrence

Motor vehicle accidents are difficult to predict. While some roads or intersections may gain a reputation as being dangerous, and others are quantitatively shown to be so, this does not necessarily mean an accident will occur with any frequency or guarantee. It represents an

elevation in the probability that an accident may occur. As such, it can be said with certainty that if no changes occur in the County then motor vehicle accidents are as likely to occur in the future as they were in the past.

It must also be taken into account that with the increase in development, associated mainly with the growth of the natural gas industry in Lycoming County, there will be more motor vehicles using its road network. This increase in traffic will also cause an increase in motor vehicle accidents. The areas with the greatest level of development, and those along major transportation routes, are likely to see an increase in both traffic and motor vehicle accidents as a secondary effect of that development. Additionally, as discussed in Section 4.3.12.4 increased heavy use of the roads by natural gas associated vehicles (an average of 44 trucks pass through a natural gas drilling site a day (Cassidy, 2014), will significantly impact and degrade the road infrastructure, resulting in thousands to millions of dollars of repair costs, as well as increased traffic fatalities. For example, a study by Resources for the Future shows that with one additional well drilled in a county, the number of accidents involving a fatality increase by 0.6 percent (Muehlenbachs and Krupnick, 2013). On the whole, though, the probability of future transportation accident events can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.16.5. Vulnerability Assessment

Lycoming County's future population growth and land use will be significantly impacted by the safety and capacity of the transportation systems traversing the County. Most residents, visitors, and tourists will use automobiles as their primary transportation throughout the community. Immigration and commercial development are also largely dependent on motor vehicle transportation systems.

All critical infrastructure within Lycoming County is vulnerable to traffic accidents, in that facility operators may be injured or delayed in performing their duties due to traffic accidents. Transportation infrastructure may be directly affected by being damaged during the accident.

Given the importance of motor vehicle traffic to the future of Lycoming County, traffic and road infrastructure planning must be a high priority for community planners and development officials. Given the opportunity to establish long-term traffic planning programs and mitigate accidents by improving safety at dangerous intersections, Lycoming County can greatly enhance the safety of its residents and visitors alike. Furthermore, taking the opportunity to learn from other high-growth areas, Lycoming County can take steps now to promote the proper balance between development and road infrastructure growth, to mitigate future problems.

4.3.17. Utility Interruption

4.3.17.1. Location and Extent

Utility interruptions, or electrical failures, are commonly a secondary effect of hazards such as severe weather and flooding. High winds, along with heavy snow, ice, and rain, can affect an electrical system's ability to function. Worker strikes at power generation facilities have also been known to cause minor power failures. Other causes of power outages include falling tree limbs, vehicular accidents, and small animals that destroy wiring. When power outages occur, they are typically on a regional scale.

Power outages can happen anywhere that power is supplied. The causes for outages are usually downed power wires or utility poles as a result of inclement weather or vehicle accidents. Additionally, outages can be caused by blown transformers or tripped circuit breakers. Most often, there is no cause reported and power is restored within the hour.

4.3.17.2. Range and Magnitude

Fourteen incidents that affected more than 150 residents were reported between 2005 and 2009. Of these incidents, half of them affected between 1,300 and 5,000 residents. An outage in Montgomery, Lycoming County, in July 2005 knocked out power for nearly 5,000 people in that area. The source of the outage was attributed to an individual who felled a tree, causing it to strike three electrical transmission lines. While no direct human casualties were reported to be associated with this event, it took some time before power was restored to customers.

4.3.17.3. Past Occurrence

Power outages have been caused by winter storms, wind, vehicle accidents, and other factors. Table 4.3.17-1 lists power outage incidents in the County from 2004 to 2009. There is no new data after 2009, because power outages are no longer reported and recorded the same way. However, it is reasonable to presume a similar frequency of outages occurring since. For example, in March 2014, there was an outage (caused by a tractor trailer knocking down several power lines) that affected 2,000 people in Lycoming County (Krize, 2014). Power outages are not an unusual occurrence, and can often be exacerbated in rural areas, because several “downed” lines can affect a large number of people.

Table 4.3.17-1 **History of Power Outages in Lycoming County from 2004-2009. (PEMA PEIRS)**

LOCATION	DATE	EVENT	COMMENTS
Franklin Township	3/21/2004	Power Outage	Power outage due to a pole fire. PPL Electric responsible for outage. Power to pole was cut off so repairs can be conducted. Approximately 1,000 customers were affected.
Williamsport	12/23/2004	Power Outage	Transformer caught fire, causing 1,800 PPL Electric customers in the City of Williamsport to be without power.
Eldred & Hepburn Township	3/8/2005	Power Outage	Power outage from SR 87 at Warrensville to SR 973E to Hepburn Township. Approximately 1,300 PPL Electric customers were affected. No critical facilities affected.
Loyalsock Township	3/23/2005	Power Outage	Fallen trees and limbs affected unknown number of PPL Electric Company customers. Substation lost transformer. Lycoming County Communications on backup generator.
Jersey Shore Borough	4/22/2005	Power Outage	T/T knocked down power lines on Culver Street. Outage affected approximately 3,000 PPL Electric customers.
Clinton Township	6/28/2005	Power Outage	Power outage at SCI-Muncy due to failed power lines that feed prison. PPL Electric able to quickly restore one line. No security measures were compromised.

Table 4.3.17-1 **History of Power Outages in Lycoming County from 2004-2009. (PEMA PEIRS)**

LOCATION	DATE	EVENT	COMMENTS
Williamsport	6/29/2005	Power Outage	Power outage at Center City Building. Possible source is a sparking electrical panel in the basement. 68 residents were evacuated.
Lewis Township	7/7/2005	Power Outage	Unknown number of PENNELEC customers without power.
Montgomery	7/20/2005	Power Outage	Individual takes down tree, hits three phase line. Estimated 3,000-5,000 without power.
Lewis Township	12/10/2005	Power Outage	Power outage affecting unknown number of First Energy customers in Lewis Township, Macintyre, Trout Run, Ralston areas, and Shriver's Tower Site. Tower is on back-up generator.
Countywide	2/25/2006	Power Outage	Power outage affecting northwest part of Lycoming County. Approximately 109 residents were affected.
Brown Township	6/26/2006	Power Outage	Power and phones down across township, possibly from severe weather.
Williamsport	8/3/2006	Power Outage	Power outage in Linden Area affecting 527 PPL Electric customers. Woodward FD shelter as a precaution.
Williamsport	8/3/2006	Power Outage	Center City Apartments reporting internal electrical disruptions. Old Lycoming FD as shelter for displaced residents.
Pine Township	12/12/2006	Power Outage	Power outage in English Center. Unknown number of affected customers.
Muncy Creek Township	3/10/2007	Power Outage	Vehicle struck telephone pole on RT 422. 900 PPL Electric customers are without power.
Shrewsbury Township	6/11/2007	Power Outage	Rural Electric Substation lost feed and caused a power outage for Lycoming and Sullivan Counties.
Williamsport	6/25/2007	Power Outage	Problem at substation caused power outage. Occurred in eastern end of Williamsport and Loyalsock Township.
Muncy Township	7/15/2007	Power Outage	PPL Electric substation between Muncy and Montoursville reported transformer fire. Residential homes and traffic lights are affected.
Lycoming Township	11/13/2007	Power Outage	Unknown number of power outages were reported. 9-1-1 center on generator.
Cogan House Township	12/5/2007	Power Outage	Tri County Electric power outage. Unknown number of customers affected.

Table 4.3.17-1 **History of Power Outages in Lycoming County from 2004-2009. (PEMA PEIRS)**

LOCATION	DATE	EVENT	COMMENTS
Muncy Township	12/11/2007	Power Outage	Power outage in Muncy Borough, Muncy Township, and Muncy Creek. 1,720 PPL Electric customers were affected. Muncy Valley Hospital was affected.
Pine Township	12/24/2007	Power Outage	Power outage affected unknown number Tri County REC in English Center Area of Pine Township.
Cummings Township	1/2/2008	Power Outage	Alleghany Power reported a fallen tree on lines in the Waterville Area.
Lewis Township	1/2/2008	Power Outage	Power outage affected one relay tower in county. First Energy responded.
Countywide	1/30/2008	Power Outage	Multiple power outages reported in Black Forest area.
Muncy Township	4/22/2008	Power Outage	Blown transformer at a substation. Muncy Valley Hospital was most likely affected.
Muncy and Wolf Townships	5/3/2008	Power Outage	Power outage affected 119 PPL Electric customers. No critical facilities were affected.
Cogan House and Pine Townships	5/21/2008	Power Outage	Power outage affecting unknown number of Tri-County customers in Cogan House and Pine Townships.
Countywide	6/29/2008	Power Outage	Severe weather caused a phone/power outage in the northwest part of Lycoming County. Power outage is coming from Germania sub-station.
Williamsport	7/16/2008	Power Outage	Power outage triggered automatic fire alarm in a high-rise building on Lycoming Street. During cause investigation, a gas meter was charged at Williamsport Manor. This did not cause fire alarm or power outage. Both the high-rise and Williamsport Manor were evacuated.
Pine Township	8/2/2008	Power Outage	Power outage affecting approximately 400 Tri-County customers.
Williamsport	8/11/2008	Power Outage	Power outage affecting 80 homes in West Williamsport, no critical facilities reported.
Williamsport	8/15/2008	Power Outage	Power outage affecting 162 PPL Electric customers.
Williamsport	8/21/2008	Power Outage	Power outage affecting an unknown number of PPL Electric customers.
Muncy Creek Township	9/6/2008	Power Outage	Unknown source of power outage at Lycoming Mall Drive and John Brady Drive.

Table 4.3.17-1 **History of Power Outages in Lycoming County from 2004-2009. (PEMA PEIRS)**

LOCATION	DATE	EVENT	COMMENTS
Muncy Creek Township	9/7/2008	Power Outage	Blown fuse on a utility box at Box Croft Trailer Park. 60 mobile homes affected.
Williamsport	10/10/2008	Power Outage	Power outage affecting approximately 358 PPL Electric customers.
Williamsport	10/22/2008	Power Outage	Approximately 2,888 PPL Electric customers without power. Williamsport Hospital and Williamsport Housing Authority 4 Elderly housing high-rise buildings affected.
Montoursville	10/25/2008	Power Outage	Blown transformer resulting in power outages for unknown number of PPL Electric customers.
Eldred Township	11/24/2008	Power Outage	Reported power outage for approximately 44 PPL Electric customers.
Cogan House Township	11/30/2008	Power Outage	Approximately 16 outages were reported in Cogan House Township and surrounding areas.
Old Lycoming Township	12/7/2008	Power Outage	209 PPL Electric customers without power.
McHenry Township	12/12/2008	Power Outage	Power outage in Waterville area, affecting Waterville Tower site.
Williamsport	12/30/2008	Power Outage	Large tree fell, downing 3 telephone poles with wires and transformers. Williamsport Hospital running on generators. Presbyterian Nursing Home was without power and required evacuation.
Pine Township	12/31/2008	Power Outage	Power outage in Pine Township, no reported accidents, critical facilities affected. Unknown number of affected individuals.
Williamsport	1/28/2009	Power Outage	A tripped circuit breaker caused a power outage in Williamsport. Unknown number of PPL Electric customers were affected.
Clinton & Montgomery Townships	2/23/2009	Power Outage	Unknown number of PPL Electric Utility customers were affected. No cause reported, no critical facilities affected.
Pine Township	4/8/2009	Power Outage	Unknown number of Tri-County Rural Electric customers were affected. No cause reported.
Loyalsock Township	4/20/2009	Power Outage	Wires from a utility pole were removed to repair damage caused by earlier fire. Approximately 650 people were without power. Two nursing homes (The Meadows and Valley View on Warrensville Rd) were affected.
Mifflin Township	4/21/2009	Power Outage	Broken utility pole that housed transformer and wires. Approximately 900 people were without power.

Table 4.3.17-1 **History of Power Outages in Lycoming County from 2004-2009. (PEMA PEIRS)**

LOCATION	DATE	EVENT	COMMENTS
Muncy Creek Township	4/25/2009	Power Outage	Approximately 3,000 PPL customers were without power. No cause was reported.
Lewis Township	5/27/2009	Power Outage	1,091 customers were affected for approximately 6 hours.

4.3.17.4. Future Occurrence

Power outages can be expected at any time of year, on a nearly monthly basis. Iced power lines; falling tree limbs due to ice, wind, or lightning strikes; and vehicle accidents damaging power lines or their support poles can all be reasons for power outages. Based on data from 2005 to 2009, the County can expect between two and 23 major power outages each year, with an annual average of nine. On the whole, though, the probability of future utility interruption events can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.2-1).

4.3.17.5. Vulnerability Assessment

Power outages pose a maximum threat to the special needs population in Lycoming County. Resources such as electricity, communications, gas, and water supply are critical to ensure the health, safety, and general welfare of the citizenry. All critical infrastructure is vulnerable to the effects of a power outage. The special needs population can be vulnerable to loss of heat or air conditioning during extreme heat; likewise they can be vulnerable to periods of severe cold if they use electric heat and there is a power outage. The County checks on its special needs population during times of extended power outage.

4.4. Hazard Vulnerability Summary

Risk and vulnerability to natural and human-made hazard events are not static. Risk will increase or decrease as states, counties, and municipalities see changes in land use and development as well as changes in population. For Pennsylvania, these changes in risk and vulnerability are likely to differ greatly from one area of the Commonwealth to another. Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. For the 2005 HMP, the Steering Committee researched the hazards that affect Lycoming County by gathering input from residents, state agencies (e.g., PEMA and the DCNR), federal agencies (e.g., United States Geological Survey [USGS], National Weather Service), and other sources. The Steering Committee then ranked the hazards that impacted the County based on individual input.

4.4.1. Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A Risk Factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also 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, general consensus opinions 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 seventeen hazards profiled in the 2014 HMP. 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. 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 *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	**1**	**10%**
	12 TO 24 HRS	SELF-DEFINED	**2**	
	6 TO 12 HRS	SELF-DEFINED	**3**	
	LESS THAN 6 HRS	SELF-DEFINED	**4**	
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS**	SELF-DEFINED *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	**1**	**10%**
	LESS THAN 24 HRS	SELF-DEFINED	**2**	
	LESS THAN 1 WEEK	SELF-DEFINED	**3**	
	MORE THAN 1 WEEK	SELF-DEFINED	**4**	

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4.2-1 lists the Risk Factor calculated for each of the seventeen potential hazards identified in the 2014 HMP. Hazards identified as *high* risk have risk factors greater than 2.5. Risk Factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with Risk Factors 1.9 and less are considered *low* risk.

Table 4.4.2-1 **Ranking of hazard types based on Risk Factor methodology.**

HAZARD RISK	HAZARD NATURAL (N) or MAN-MADE (M)	RISK ASSESSMENT CATEGORY					RISK FACTOR
		PROBABILITY (1-4)	IMPACT (1-4)	SPATIAL EXTENT (1-4)	WARNING TIME (1-4)	DURATION (1-4)	
HIGH	Flood, Flash Flood, Ice Jam (N)	4	3	3	2	3	3.2
	Winter Storm (N)	4	2	4	2	2	3.0
	Utility Interruption (M)	4	2	1	4	2	2.6
MODERATE	Drought (N)	2	2	3	1	4	2.3
	Transportation Accident (M)	4	1	1	4	1	2.2
	Nuclear Incident (M)	1	2	2	4	4	2.1
	Wildfire (N)	3	1	1	4	3	2.1
	Environmental Hazard (M)	3	1	1	4	2	2.0
	Dam Failure (M)	1	3	1	4	2	2.0
LOW	Tornado, Windstorm (N)	2	2	1	4	1	1.9
	Radon (N)	2	1	2	1	4	1.8
	Earthquake (N)	1	1	3	4	1	1.7
	Hailstorm (N)	2	1	2	3	1	1.7
	Disorientation (M)	2	1	1	4	2	1.7
	Terrorism (M)	1	2	1	4	1	1.6
	Levee Failure	1	2	1	4	1	1.6
	Subsidence, Sinkhole (N)	1	1	1	4	1	1.3

Based on these results, there are three *high* risk hazards, six *moderate* risk hazards and eight *low* risk hazards in Lycoming County. Mitigation actions were developed for all hazards (see Section 6.4) with an emphasis on the higher-ranked hazards.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. Table 4.4.2-2 shows the different municipalities in Lycoming County and whether their risk is greater than (>), less than (<), or equal to (=) the risk factor assigned to the County as a whole. This table was developed based on the findings in the hazard profiles of Section 4.3 and municipal input from the "Hazards in Your Community" worksheet distributed at the July 24, 2015 HMP Update meeting. Those changes are reflected in the table.

Table 4.4.2-2 **Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk**

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR																
	Flood, Flash Flood, Ice Jam (N)	Winter Storm (N)	Utility Interruption (M)	Drought (N)	Transportation Accident (M)	Nuclear Incidents (M)	Wildfire (N)	Environmental Hazard (M)	Dam Failure (M)	Tornado, Windstorm (N)	Earthquake (N)	Radon Exposure (N)	Hailstorm (N)	Disorientation (M)	Levee Failure (M)	Terrorism (M)	Subsidence, Sinkhole (M)
	3.2	*3.0*	*2.6*	*2.3*	*2.2*	*2.1*	*2.1*	*2.0*	*2.0*	*1.9*	*1.7*	*1.8*	*1.7*	*1.7*	*1.2*	*1.6*	*1.3*
Anthony Township	=	=	=	=	=	<	=	=	=	=	=	>	=	=	<	=	=
Armstrong Township	=	=	=	=	=	=	=	<	>	=	=	>	=	=	<	=	=
Bastress Township	<	=	=	=	=	=	=	<	<	=	=	>	=	=	<	=	=
Brady Township	=	=	=	=	=	=	=	<	=	=	=	=	=	=	<	=	>
Brown Township	=	=	=	=	<	<	=	<	<	=	=	=	=	=	<	=	=
Cascade Township	=	=	=	=	<	=	=	=	<	=	=	=	=	=	<	=	=
Clinton Township	=	=	=	=	=	=	=	<	=	=	=	=	=	=	<	=	>
Cogan House Township	=	=	=	=	<	<	=	=	<	=	=	=	=	=	<	=	=
Cummings Township	=	=	=	=	<	<	=	=	>	=	=	=	=	=	<	=	=
Duboistown Borough	=	=	=	=	=	<	<	<	=	=	=	>	=	<	<	=	>
Eldred Township	=	=	=	=	=	=	=	=	<	=	=	>	=	=	<	=	=
Fairfield Township	=	=	=	=	>	=	=	=	<	=	=	>	=	=	<	=	>
Franklin Township	=	=	=	=	<	=	=	=	=	=	=	=	=	=	<	=	=
Gamble Township	=	=	=	=	=	=	=	=	>	=	=	>	=	=	<	=	=
Hepburn Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=	=
Hughesville Borough	=	=	=	=	=	=	<	<	<	=	=	=	=	<	<	=	=
Jackson Township	=	=	=	=	=	<	=	=	<	=	=	=	=	=	<	=	=
Jersey Shore Borough	=	=	=	=	=	<	<	<	<	=	=	=	=	<	<	=	=
Jordan Township	=	=	=	=	<	=	=	=	<	=	=	=	=	=	<	=	=
Lewis Township	=	=	=	=	=	=	=	=	<	=	=	>	=	=	<	=	=
Limestone Township	=	=	=	=	<	=	=	<	>	=	=	>	=	=	<	=	>
Loyalsock Township	=	=	=	=	>	=	=	<	<	=	=	>	=	=	>	=	>
Lycoming Township	=	=	=	=	=	=	=	=	<	=	=	>	=	=	<	=	=
McHenry Township	=	=	=	=	<	<	=	=	<	=	=	=	=	=	<	=	=
McIntyre Township	=	=	=	=	<	=	=	=	=	=	=	=	=	=	<	=	=
McNett Township	=	=	=	=	<	=	=	=	<	=	=	=	=	=	<	=	=
Mifflin Township	=	=	=	=	=	<	=	=	=	=	=	>	=	=	<	=	=
Mill Creek Township	=	=	=	=	<	=	=	=	<	=	=	>	=	=	<	=	=
Montgomery Borough	=	=	=	=	=	=	<	<	<	=	=	=	=	<	<	=	=
Montoursville Borough	=	=	=	=	=	=	<	<	<	=	=	>	=	<	<	=	>

Table 4.4.2-2 **Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk**

JURISDICTION	IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR																
	Flood, Flash Flood, Ice Jam (N)	Winter Storm (N)	Utility Interruption (M)	Drought (N)	Transportation Accident (M)	Nuclear Incidents (M)	Wildfire (N)	Environmental Hazard (M)	Dam Failure (M)	Tornado, Windstorm (N)	Earthquake (N)	Radon Exposure (N)	Hailstorm (N)	Disorientation (M)	Levee Failure (M)	Terrorism (M)	Subsidence, Sinkhole (M)
	3.2	*3.0*	*2.6*	*2.3*	*2.2*	*2.1*	*2.1*	*2.0*	*2.0*	*1.9*	*1.7*	*1.8*	*1.7*	*1.7*	*1.2*	*1.6*	*1.3*
Moreland Township	=	=	=	=	<	=	=	=	<	=	=	=	=	=	<	=	=
Muncy Borough	=	=	=	=	=	=	<	<	<	=	=	=	=	<	<	=	>
Muncy Township	=	=	=	=	=	=	=	<	<	=	=	=	=	=	<	=	>
Muncy Creek Township	=	=	=	=	=	=	=	<	<	=	=	=	=	=	<	=	>
Nippenose Township	=	=	=	=	=	<	=	<	<	=	=	>	=	=	<	=	>
Old Lycoming Township	=	=	=	=	>	=	=	<	<	=	=	>	=	=	>	=	=
Penn Township	=	=	=	=	<	=	=	=	=	=	=	=	=	=	<	=	=
Piatt Township	=	=	=	=	=	<	=	<	<	=	=	>	=	=	<	=	>
Picture Rocks Borough	=	=	=	=	=	=	<	<	<	=	=	=	=	<	<	=	=
Pine Township	=	=	=	=	<	<	=	=	<	=	=	=	=	=	<	=	=
Plunketts Creek Township	=	=	=	=	<	=	=	=	=	=	=	=	=	=	<	=	=
Porter Township	=	=	=	=	>	<	=	<	<	=	=	=	=	=	<	=	>
Salladasburg Borough	=	=	=	=	=	<	<	<	<	=	=	=	=	<	<	=	=
Shrewsbury Township	=	=	=	=	<	=	=	=	=	=	=	=	=	=	<	=	=
South Williamsport	=	=	=	<	>	=	<	<	=	=	=	=	=	=	>	>	>
Susquehanna Township	=	=	=	=	=	=	=	<	<	=	=	>	=	=	<	=	>
Upper Fairfield Township	=	=	=	=	=	=	=	=	<	=	=	>	=	=	<	=	=
Washington Township	=	=	=	=	<	=	=	<	<	=	=	=	=	=	<	=	>
Watson Township	=	=	=	=	<	<	=	=	=	=	=	=	=	=	<	=	=
Williamsport, City of	=	=	=	<	>	=	<	<	=	=	=	>	=	=	>	=	>
Wolf Township	=	=	=	=	=	=	=	<	<	=	=	=	=	=	<	=	=
Woodward Township	=	=	=	=	=	<	=	<	<	=	=	>	=	=	<	=	=

4.4.3. Potential Loss Estimates

Potential loss estimates for hazard events help a community understand the monetary value of what might be at stake during a hazard event. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

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

Historical losses were able to be determined for drought, flooding, hailstorms, tornado and windstorms, and winter storms from NCDC and the NFIP. NCDC reports include property and crop damage estimates with their incident reports. As noted in many of the hazard profiles, though, many of the events have no damages reported. This does not mean that there were no damage; rather, it indicates that no damages were reported to NCDC. As a result, these should be considered low-end estimates of losses. For example, the flood and flash flood events reported in NCDC list $12,160,000 in property damage and six fatalities over the history of flooding in the county. Hailstorm losses reported to the NCDC totaled $350,000 in property damage and $500,000 in crop loss. Property damage estimates for tornado were reported at a little over $28 million, with a range of property damage from $2,500 to $25 million. Wind events of over 50 knots had estimated losses of three fatalities and two injuries, as well as $302,500 in property damage. Historical losses for winter storms, including ice storms, freezing rain, sleet, and heavy snow, include just $8,000 in property damage.

Other historic losses relate solely to prior flood losses and come from the NFIP's records of claims paid. Table 4.4.3-1 shows the total amount of claims paid in each municipality according to CIS. Muncy Borough, Old Lycoming Township, and Plunketts Creek Township have had the highest total amount of claims paid, and there are five communities that have never had a claim paid despite having policies in force in the community.

Table 4.4.3-1 **Lycoming County Historic Flood Losses (FEMA CIS, 2014).**

COMMUNITY	PARTICIPATING?	TOTAL AMOUNT OF PAID CLAIMS
Anthony Township	YES	$0.00
Armstrong Township	YES	$696,782.33
Bastress Township	YES	$0.00

Table 4.4.3-1 **Lycoming County Historic Flood Losses (FEMA CIS, 2014).**

COMMUNITY	PARTICIPATING?	TOTAL AMOUNT OF PAID CLAIMS
Brady Township	YES	$25,955.69
Brown Township	YES	$84,768.21
Cascade Township	YES	$24,918.48
Clinton Township	YES	$219,384.69
Cogan House Township	YES	$1,491.56
Cummings Township	YES	$459,468.18
Duboistown Borough	YES	$207,666.14
Eldred Township	YES	$290,543.71
Fairfield Township	YES	$1,458,864.68
Franklin Township	YES	$80,942.13
Gamble Township	YES	$498,222.35
Hepburn Township	YES	$3,128,354.46
Hughesville Borough	YES	$58,998.88
Jackson Township	YES	$0.00
Jersey Shore Borough	YES	$1,729,310.89
Jordan Township	YES	$554.66
Lewis Township	YES	$3,353,118.32
Limestone Township	YES	$0.00
Loyalsock Township	YES	$3,661,891.02
Lycoming Township	YES	$3,615,371.50
McHenry Township	YES	$165,776.27
McIntyre Township	YES	$541,559.58
McNett Township	YES	$32,830.94
Mifflin Township	YES	$17,057.98
Mill Creek Township	YES	$0.00
Montgomery Borough	YES	$1,313,428.16
Montoursville Borough	YES	$2,647,225.54
Moreland Township	YES	$170,706.98
Muncy Borough	YES	$5,545,457.61
Muncy Township	YES	$88,676.70
Muncy Creek Township	YES	$3,389,612.89
Nippenose Township	YES	$157,149.23

Table 4.4.3-1 **Lycoming County Historic Flood Losses (FEMA CIS, 2014).**

COMMUNITY	PARTICIPATING?	TOTAL AMOUNT OF PAID CLAIMS
Old Lycoming Township	YES	$8,678,894.87
Penn Township	YES	$217,790.17
Piatt Township	YES	$580,091.00
Picture Rocks Borough	YES	$72,222.21
Pine Township	YES	$292,902.27
Plunketts Creek Township	YES	$5,562,014.42
Porter Township	YES	$92,865.07
Salladasburg Borough	YES	$0.00
Shrewsbury Township	YES	$149,442.24
South Williamsport	YES	$392,327.21
Susquehanna Township	YES	$283,567.93
Upper Fairfield Township	YES	$2,351,814.87
Washington Township	YES	$0.00
Watson Township	YES	$441,472.83
Williamsport, City of	YES	$1,425,146.14
Wolf Township	YES	$306,908.02
Woodward Township	YES	$531,282.11
TOTAL		**$55,044,831.12**

Another way of looking at loss estimates is to look at the total assessed value of properties in each municipality in Lycoming County that are located within areas vulnerable to floods and levee failure-related flooding, subsidence, and wildfires. The assessed value of these properties was calculated from the Lycoming County Parcel Tax Assessment database for each of the 52 municipalities; the parcel centroid was used in this analysis. The end result of the analysis will allow reasonable determinations of the estimated potential loss in each of the 52 municipalities. The results are enumerated in Table 4.4.3-2 below. It is important to note that there were some properties that had no value information populated in the parcel database. As a result, there may be communities that have buildings identified as vulnerable to a particular hazard, but do not have an estimated dollar amount of exposed value. The estimated losses can only be presented as potential, based on the random occurrence of hazard conditions and limited data. Lycoming County parcels have a cumulative value of nearly $5.5 billion.

Table 4.4.3-2 **Loss estimates based on the value of parcels in Lycoming County vulnerable to profiled hazards.**

MUNICIPALITY	TOTAL ASSESSED VALUE OF PARCELS	TOTAL ASSESSED VALUE OF PARCELS IN SFHA	TOTAL ASSESSED VALUE OF PARCELS PROTECTED BY LEVEES	TOTAL ASSESSED VALUE OF PARCELS IN SUBSIDENCE-PRONE AREAS	TOTAL ASSESSED VALUE OF PARCELS IN WILDFIRE PRONE AREAS
Anthony Township	$48,742,610	$1,465,170	$0	$0	$15,307,450
Armstrong Township	$52,563,800	$6,770,020	$0	$865,910	$52,563,800
Bastress Township	$29,562,380	$39,500	$0	$0	$4,569,970
Brady Township	$26,183,580	$589,200	$0	$5,648,840	$24,601,860
Brown Township	$34,967,420	$4,629,780	$0	$0	$34,967,420
Cascade Township	$33,719,670	$1,679,690	$0	$0	$33,533,640
Clinton Township	$228,144,200	$13,961,290	$0	$11,190,090	$201,399,350
Cogan House Township	$69,876,860	$1,355,650	$0	$0	$42,526,530
Cummings Township	$43,545,190	$13,570,820	$0	$0	$43,128,290
Duboistown Borough	$51,492,790	$5,853,150	$0	$10,157,200	$51,492,790
Eldred Township	$119,212,300	$3,482,320	$0	$0	$87,388,350
Fairfield Township	$212,367,120	$6,474,790	$0	$25,018,790	$131,129,410
Franklin Township	$58,529,970	$2,995,290	$0	$0	$14,275,030
Gamble Township	$59,737,230	$1,567,890	$0	$0	$58,435,040
Hepburn Township	$160,411,570	$11,897,490	$0	$0	$13,226,040
Hughesville Borough	$101,717,640	$203,220	$0	$0	$0
Jackson Township	$32,323,720	$1,159,690	$0	$0	$8,651,330
Jersey Shore Borough	$160,995,600	$70,994,850	$0	$0	$44,543,480
Jordan Township	$52,893,240	$1,213,180	$0	$0	$19,739,880
Lewis Township	$52,772,130	$13,263,160	$0	$0	$37,789,200
Limestone Township	$109,551,580	$4,082,030	$0	$65,216,790	$96,325,900
Loyalsock Township	$801,169,870	$29,348,850	$146,552,190	$11,401,200	$183,538,550
Lycoming Township	$78,865,540	$16,562,820	$0	$0	$352,210
McHenry Township	$40,413,290	$5,678,390	$0	$0	$40,413,290
McIntyre Township	$30,020,940	$7,145,990	$0	$0	$30,020,940
McNett Township	$21,851,290	$1,095,520	$0	$0	$21,851,290
Mifflin Township	$60,637,730	$9,087,430	$0	$0	$19,187,790
Mill Creek Township	$36,773,910	$1,408,250	$0	$0	$22,144,830
Montgomery Borough	$44,096,250	$16,390,760	$0	$0	$31,314,050
Montoursville Borough	$325,012,750	$8,118,160	$0	$64,696,760	$270,944,320
Moreland Township	$65,030,280	$1,724,860	$0	$0	$5,944,320
Muncy Borough	$118,119,460	$37,761,070	$0	$27,682,740	$61,045,890
Muncy Creek Township	$214,103,550	$31,056,380	$0	$45,633,910	$81,608,900
Muncy Township	$220,974,870	$4,368,230	$0	$84,516,730	$163,081,550
Nippenose Township	$34,581,020	$5,703,020	$0	$3,454,620	$34,263,180

Table 4.4.3-2 **Loss estimates based on the value of parcels in Lycoming County vulnerable to profiled hazards.**

MUNICIPALITY	TOTAL ASSESSED VALUE OF PARCELS	TOTAL ASSESSED VALUE OF PARCELS IN SFHA	TOTAL ASSESSED VALUE OF PARCELS PROTECTED BY LEVEES	TOTAL ASSESSED VALUE OF PARCELS IN SUBSIDENCE-PRONE AREAS	TOTAL ASSESSED VALUE OF PARCELS IN WILDFIRE PRONE AREAS
Old Lycoming Township	$264,217,660	$30,434,360	$32,741,640	$0	$100,034,340
Penn Township	$60,263,850	$3,343,590	$0	$0	$1,747,510
Piatt Township	$48,843,160	$9,126,630	$0	$471,290	$6,679,080
Picture Rocks Borough	$31,318,470	$1,802,900	$0	$0	$0
Pine Township	$46,505,900	$7,051,140	$0	$0	$43,660,900
Plunketts Creek Township	$58,372,000	$9,838,420	$0	$0	$58,372,000
Porter Township	$102,011,000	$15,075,730	$0	$4,687,160	$69,656,090
Salladasburg Borough	$10,290,030	$1,624,000	$0	$0	$0
Shrewsbury Township	$29,231,060	$4,127,770	$0	$0	$8,929,150
South Williamsport Borough	$282,109,570	$8,221,000	$55,790,400	$32,266,450	$282,109,570
Susquehanna Township	$47,487,050	$8,947,950	$0	$7,783,520	$31,564,560
Upper Fairfield Township	$112,694,220	$6,452,750	$0	$17,583,970	$58,399,970
Washington Township	$95,205,970	$8,553,040	$0	$0	$95,205,970
Watson Township	$41,288,580	$11,070,560	$0	$0	$40,900,880
Williamsport, City of	$136,493,112	$13,578,720	$753,854,460	$31,388,940	$907,355,180
Wolf Township	$164,586,350	$8,119,610	$0	$0	$11,726,810
Woodward Township	$95,879,690	$12,109,870	$0	$585,180	$8,061,300
TOTAL	**$5,457,759,022**	**$502,175,950**	**$988,938,690**	**$450,250,090**	**$3,705,709,180**

Finally, losses were generated using HAZUS-MH, version 2.1. This plan employed an enhanced HAZUS analysis for floods. As opposed to basic analysis using only default data, enhanced analysis incorporates some kind of more recent, up-to-date, or specific data for inclusion in the hazard models. The enhanced data incorporated into this HMP update include:

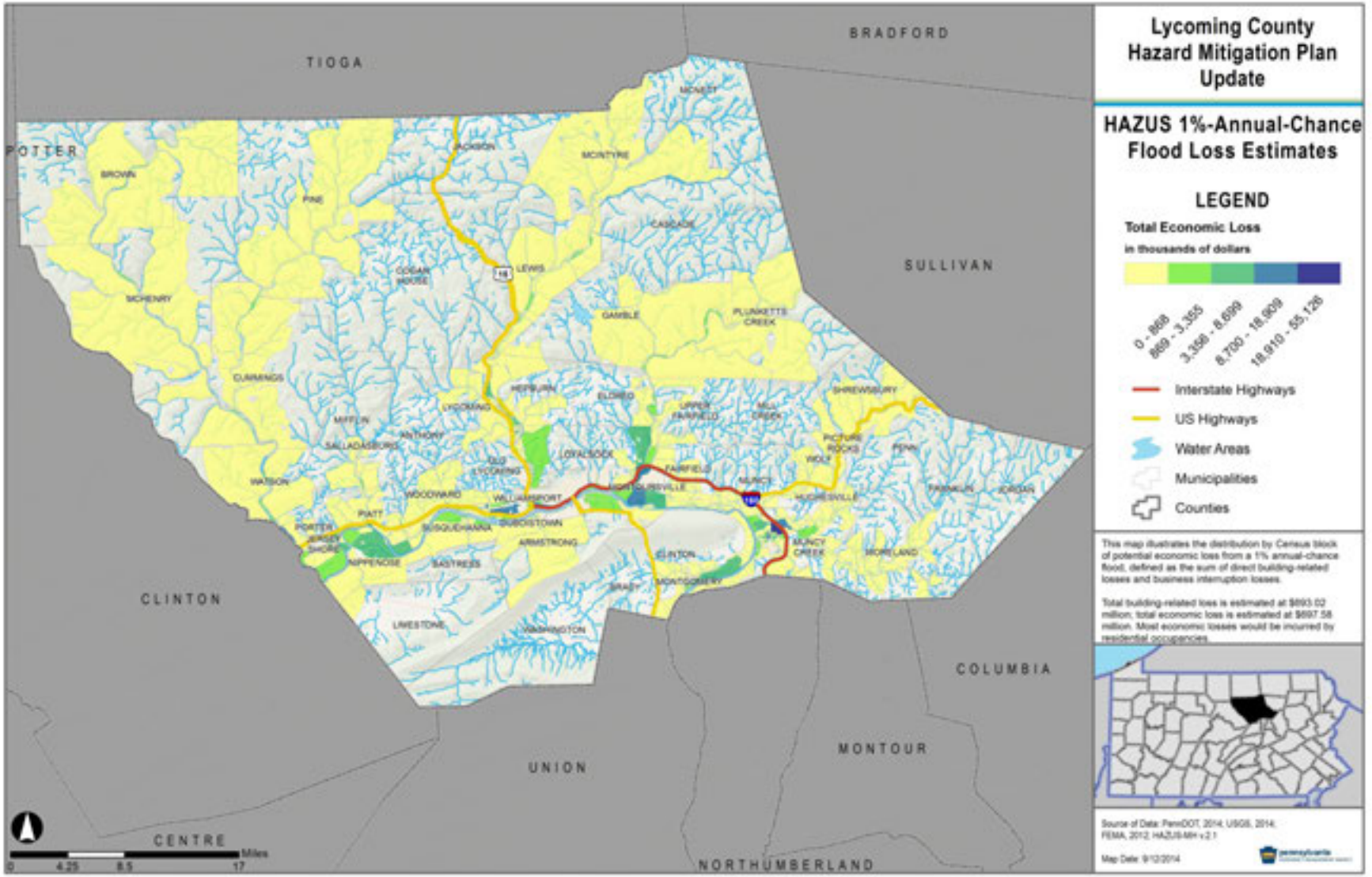
- Updated demographic data from the 2010 Census,
- Updated essential facilities data from the County and other sources, and
- The 1%-annual-chance depth grid generated as a part of Lycoming County's Risk MAP process.

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

Total economic loss, including replacement value, content loss, functional loss and displacement cost, from a countywide 1%-annual-chance flood are estimated to equal $697.58 million. Residential occupancies make up 39% of the total estimated building-related losses, and a further 30% of the damages are incurred by commercial uses. Figure 4.4.3-2 shows a

distribution of building-related losses by census block across Lycoming County. The highest losses are expected near Williamsport, Muncy Borough, and Montoursville. In this scenario, an expected 1,016 buildings would be at least moderately damaged, and 492 would be substantially damaged. Of the substantially damaged structures, nearly all are residential properties (489 of 492). In addition, and estimated 2,982 households would be displaced, and 6,483 people would require temporary shelter. None of the essential facilities would experience substantial damage, but four (three fire stations, three police stations, and one school) would have at least moderate damage. Six of the essential facilities with damage are expected to experience at least some loss of use.

Figure 4.4.3-2 **Total economic losses estimated by HAZUS-MH.**



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. Lycoming 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 the 2000 and 2010 to aid both county and municipality comprehensive planning. Projections developed for each of Lycoming County's municipalities are shown in Table 4.4.4-1. These projections are mapped in Figure 4.4.4-4.

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

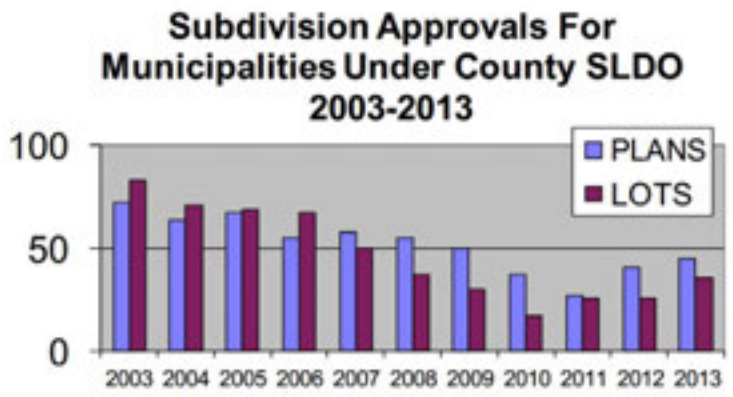
MUNICIPALITY	BASELINE POPULATION 2010 US CENSUS	POPULATION PROJECTIONS			PERCENT CHANGE, 2010-2040
		2020	2030	2040	
Duboistown Borough	1,205	1,218	1,181	1,172	-2.7%
Hughesville	2,128	2,186	2,159	2,180	2.4%
Jersey Shore	4,361	4,383	4,323	4,310	-1.2%
Montgomery	1,579	1,566	1,494	1,456	-7.8%
Montoursville	4,615	4,428	4,255	4,074	-11.7%
Muncy	2,477	2,375	2,225	2,102	-15.1%
Picture Rocks	678	690	687	693	2.2%
Salladasburg	238	217	197	176	-26.1%
South Williamsport	6,379	6,317	6,271	6,216	-2.6%
Williamsport	29,381	28,112	26,811	25,528	-13.1%
TOTAL: Boroughs	*53,041*	*51,492*	*49,603*	*47,907*	*-9.7%*
Anthony	865	949	963	1,018	17.7%
Armstrong	681	689	672	669	-1.8%
Bastress	546	569	563	573	4.9%
Brady	521	474	558	567	8.8%
Brown	96	95	86	82	-14.6%
Cascade	413	432	436	449	8.7%
Clinton	3,708	3,975	4,443	4,796	29.3%
Cogan House	955	1,042	1,069	1,130	18.3%
Cummings	273	248	226	202	-26.0%
Eldred	2,122	2,168	2,156	2,177	2.6%

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	
Fairfield	2,792	2,894	3,014	3,124	11.9%
Franklin	933	941	955	966	3.5%
Gamble	756	777	730	722	-4.5%
Hepburn	2,762	2,731	2,676	2,635	-4.6%
Jackson	396	384	369	356	-10.1%
Jordan	863	861	851	845	-2.1%
Lewis	987	898	817	732	-25.8%
Limestone	2,019	2,108	2,079	2,117	4.9%
Loyalsock	11,026	11,223	11,393	11,578	5.0%
Lycoming	1,478	1,345	1,224	1,096	-25.8%
McHenry	143	130	123	113	-21.0%
McIntyre	520	484	458	426	-18.1%
McNett	174	164	150	138	-20.7%
Mifflin	1,070	1,058	1,010	982	-8.2%
Mill Creek	604	672	719	779	29.0%
Moreland	943	933	875	845	-10.4%
Muncy Creek	3,474	3,518	3,529	3,559	2.4%
Muncy	1,089	1,115	1,143	1,170	7.4%
Nippenose	709	693	675	658	-7.2%
Old Lycoming	4,938	4,683	4,262	3,936	-20.3%
Penn	960	1,050	1,122	1,205	25.5%
Piatt	1,180	1,239	1,219	1,244	5.4%
Pine	294	301	284	281	-4.4%
Plunketts Creek	684	622	566	507	-25.9%
Porter	1,601	1,697	1,720	1,785	11.5%
Shrewsbury	409	416	406	406	-0.7%
Susquehanna	1,000	973	965	946	-5.4%
Upper Fairfield	1,823	1,855	1,852	1,869	2.5%
Washington	1,619	1,656	1,676	1,706	5.4%
Watson	537	523	509	496	-7.6%
Wolf	2,907	3,044	3,217	3,370	15.9%
Woodward	2,200	2,190	2,073	2,017	-8.3%
TOTAL: Townships	*63,070*	*63,819*	*63,833*	*64,272*	*-0.9%*
Lycoming County	**116,111**	**115,311**	**113,436**	**112,179**	**-6.6%**

As shown in Table 4.4.4-1 the County is expecting to lose population as a whole, with only a few areas expecting any growth. Clinton, Mill Creek, and Penn are the only townships expecting to see over 20% growth, and all but two of the boroughs – Hughesville and Picture Rocks – are expected to lose population. According to the 2013 Lycoming County Planning Commission Annual Report, in 2013, there were 108 subdivision and land development plans submitted for advisory comment to the County, compared to 133 plans in 2012. In addition to these 108 plans, there were 8 addition-lot plans, 73 single-lot and multi-lot plans, and 28 land development plans reviewed by the County in 2013 (Lycoming County Planning Commission Annual Report, 2013). Among the proposals, some of the most notable included: a 40 unit multi-story residential building and a 32-unit senior housing complex, both in Williamsport, and a new four-story building within Susquehanna Health's Campus in Williamsport. Under the County Subdivision and Land Development Ordinance (SLDO), a total of 36 new lots were created (an increase of 10 lots from 2012), and an additional 25 lots were added to existing, adjacent properties. Figure 4.4.4-2 displays the change in plans and lots approvals under County SLDO from 2003 to 2013.

Figure 4.4.4-2 **Subdivision approvals for municipalities under County SLDO 2003-2013 (Lycoming County Planning Commission Annual Report 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 effort by the County and municipalities to examine potential future development in floodplain areas (including: Muncy Creek, Montoursville/Muncy, US-220/Future I-99, US-15 South, the Greater Williamsport Alliance, and Lower Lycoming Creek Comprehensive Plans (Lycoming County Plans, 2006)) during comprehensive planning efforts in 2006 is a good first step at managing where development is going and should go. Communities that fall within the designated future growth areas and the SFHA largely follow along the West Branch of the

Susquehanna River and Lycoming, Loyalsock and Muncy Creeks. These communities are as follows:

- Armstrong Township
- Brady Township
- Clinton Township
- Duboistown Borough
- Fairfield Township
- Gregg Township
- Hughesville Borough
- Jersey Shore Borough
- Loyalsock Township
- Lycoming Township
- Montoursville Borough
- Muncy Borough
- Muncy Creek Township
- Muncy Township
- Old Lycoming Township
- Piatt Township
- Porter Township
- South Williamsport Borough
- The City of Williamsport
- Wolf Township
- Woodward Township

However, the County has made it a priority to steer future development away from the SFHA. As outlined in the Comprehensive Plan, the County will use zoning to concentrate and guide development within the identified growth areas; restore natural floodplains through acquisition and demolition; preserve open space and farmland; and coordinate land use development to provide for mixed use development, greenfields development, and the preservation of natural resources (Lycoming County Comprehensive Plan, 2006). The specific County objectives for steering future growth away from flood prone areas are outlined in Chapter 3, page 3-16 of the Comprehensive Plan. These objectives are as follows: “1) Restrict new floodplain development through County and local ordinances, 2) Provide incentives for new development to locate in targeted growth areas, rather than in floodplains, and 3) Require and enforce flood proofing and flood mitigation requirements for existing properties.”

Within the Comprehensive Plan, the County has identified the strategies that it will implement to meet these objectives, as illustrated in Figure 4.4.4-3. Within these strategies, the following “Strategic Actions” specifically limit or prohibit future development in the SFHA and/or aim to reduce the impacts associated with flooding:

- Strategic Action 1l.: “Revise local and County ordinances to prohibit new floodplain development and to regulate expansion of existing floodplain development.”

- Strategic Action 1m.: “Revise property maintenance codes to include flood proofing and flood mitigation for existing properties in the floodplain.”

- Strategic Action 1n.: “Review and revise local and County zoning ordinances to permit additional private and public recreation uses.”

- Strategic Action 3c.: “Provide information on the use of growth areas for sound land use planning and community development.

- Strategic Action 3d.: “Provide information on the impacts of building and expanding development in the floodplain.”

- Strategic Action 8g.: “Coordinate infrastructure improvements and expansion within growth areas. Discourage infrastructure investment in rural resource areas.”

Figure 4.4.4-3 **Lycoming County Strategic Actions to Guide Countywide Land Use (Lycoming County Comprehensive Plan, 2006)**

Matrix 2 Potential Breadth of Impact of Land Use and Resource Management Strategies

Strategic Action	Key Issues for Rural Lycoming County: Guidance for highway-related development	Appropriate CAFO location	Reduction of visible junk/salvage	Conservation of steep slopes and ridgetops	Natural Resource Protection	Historic and cultural resource protection	Floodplain Management	Guidance for development pressure	Potential recreation/tourism development of open space/public lands	Open space and agricultural preservation	Water supply/water quality protection
Review and revise ordinances to ensure that they are consistent with the goals and objectives of the comprehensive plan.	X	X	X	X	X	X	X	X	X	X	X
Develop and support additional public and/or private programs to achieve the comprehensive plan's goals and objectives.	X		x	X	X	X			x	x	
Develop public education programs to address environmental concerns related to land use and property maintenance.		X	X						x		
Support the continued presence of agricultural and forest industries.		X					X	X	X	x	
Improve community image through fostering community pride and enforcement of property maintenance codes.			X								
Coordinate resource inventory, management, and protection.				X	X	X					x
Coordinate economic development and transportation and infrastructure planning with land use planning					x		X	X	X	X	X
Utilize land management to protect natural resources.							X	X		X	X

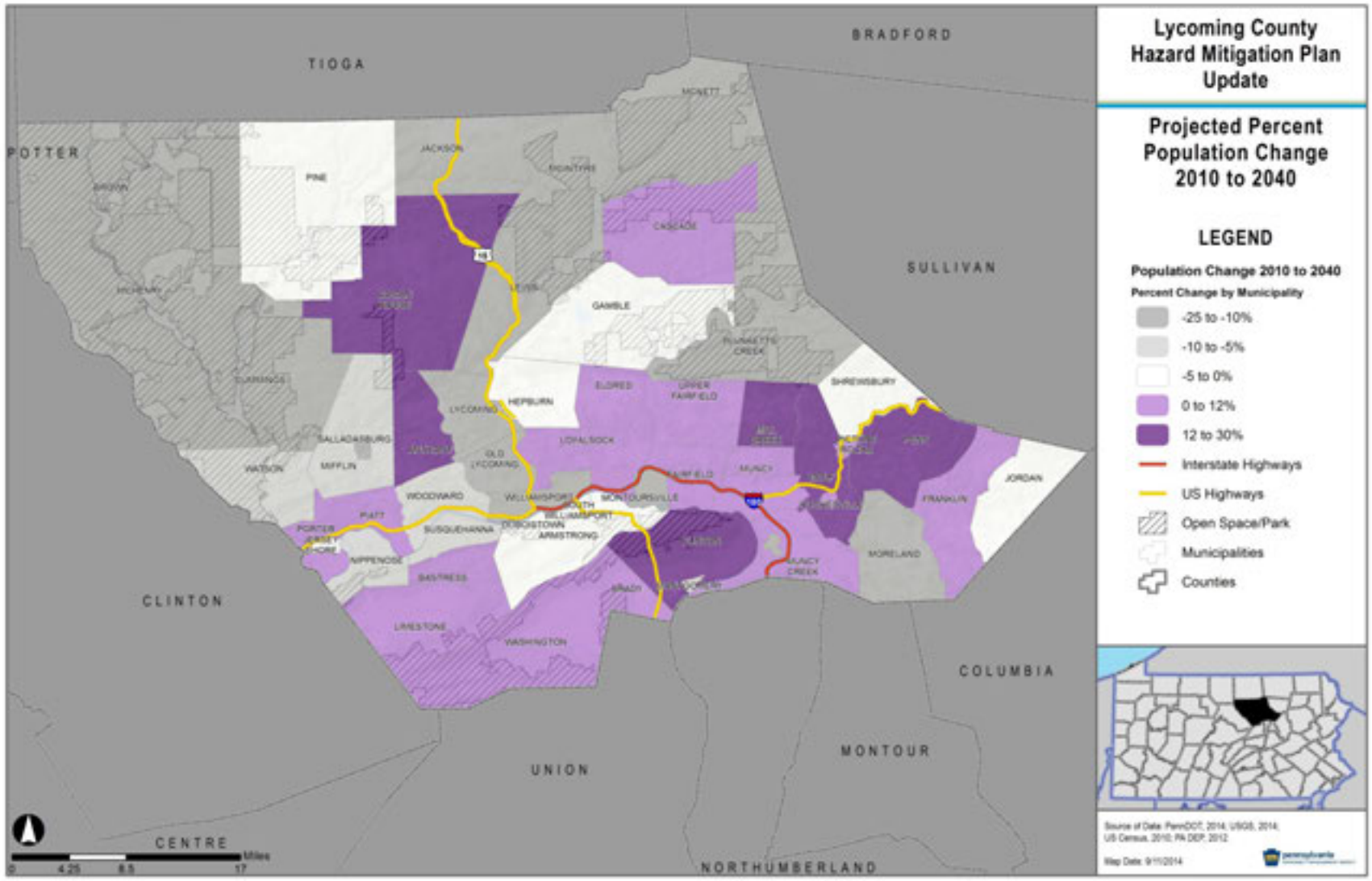
With a decrease in population and slight decline in the rate of new residential development, it would be expected that vulnerability and risk would also see a decline. However, despite the population decline, there is one significant development change in Lycoming County that has occurred in the last five years, and is expected to continue; the natural gas industry. Of the 487

Zoning Development Permits during 2013, the natural gas industry comprised 28% of these permits (with residential making up the largest portion 46%), the next industry with as many permits is agriculture at 5% (Lycoming County Planning Commission Annual Report 2013). Given the slow residential development and declining population, the natural gas industry becomes the single most influential variable in Lycoming County's future vulnerability and risk.

The expansion of the natural gas industry in Lycoming County will impact the county much like additional, traditional development, except with added and longer-lasting environmental impacts, that aren't fully known. As explored in Section 4.3.12.4, 4% of the County was converted (predominantly) from forest to impervious surface within the past five years, due to the natural gas industry alone. 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 Lycoming County's future vulnerabilities and risk, greater care and oversight could be taken to balance future well development with watershed needs and conservation goals.

Figure 4.4.4-4 **Projected Percent Population Change from 2010 – 2040 by Municipality.**



5. Capability Assessment

5.1. Update Process Summary

Performing the Capability Assessment is important to formulate a viable mitigation strategy later in the planning process. A Capability Assessment has two components: an inventory of a jurisdiction's existing planning and regulatory tools and an analysis of its capacity to use them effectively. The assessment process helps identify existing gaps, conflicts, and/or weaknesses that may need to be addressed through future mitigation planning goals, objectives, and actions. It also highlights the measures in place or already undertaken that merit continued support and enhancement through future mitigation efforts. The Capability Assessment also helps to ensure that proposed mitigation actions are practical, considering the local ability to implement them.

The Capability Assessment is an evaluation of Lycoming County's governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and ordinances, and resource availability. Each category is evaluated for its strengths and weaknesses in responding to, preparing for, and mitigating the effects of the identified hazards. The Capability Assessment has two components: (1) an inventory of the County's and municipalities' mission, programs, and policies; and (2) an analysis of their capacity to execute them. A Capability Assessment is an integral part of the hazard mitigation planning process. Here, the County and municipalities identify, review, and analyze what they are currently doing to reduce losses and to identify the framework necessary to implement new mitigation actions. This information will help the County and municipalities evaluate alternative mitigation actions and address shortfalls in the mitigation plan.

The evaluation of the categories listed above – governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and ordinances, and resource availability – allows the Steering Committee to determine the viability of certain mitigation actions. The Capability Assessment analyzes what Lycoming County and its municipalities have the capacity to do and provides an understanding of what must be changed to mitigate loss.

Throughout the planning process, the Steering Committee considered the County's 52 individual municipalities. Pennsylvania municipalities have their own governing bodies, pass and enforce their own ordinances and regulations, purchase equipment, and manage their own resources, including critical infrastructure. Therefore, this Capability Assessment must consider the various characteristics and capabilities of each municipality under study.

To identify these capabilities, a Capability Assessment survey was developed at the beginning of the 2009 Plan update process. The 2009 survey was returned to each municipality (if one had been received) and representatives were asked to update information as needed. If a survey was not completed in 2009 as part of that HMP Update process, a blank form was provided to the municipality for completion during the 2015 HMP Update. Copies of the survey are available in Appendix C. Additionally an NFIP Checklist was partially completed by the consultant, using information obtained through FEMA's Community Information System (CIS) and distributed to each municipal official. Items not populated through CIS were filled out and

described by the municipal representative regarding permitting and floodplain management procedures.

5.2. Capability Assessment Findings

Below are descriptions of the items listed in the Capability Assessment survey. Table 5.2-1 summarizes major planning tools in each Lycoming County municipality.

Table 5.2-1 Major Planning Tools in Lycoming County

Municipality	Comprehensive Land Use Plan	NFIP/FP Regulations	Subdivision Regulations	Zoning Regulations
Anthony Township	County	X	County	X
Armstrong Township	Greater Williamsport Alliance, 2005	X	X	X
Bastress Township	County	County	County	County
Brady Township	US 15 South, 2005	X	X	X
Brown Township	County	County	County	County
Cascade Township	County	County	X	County
Clinton Township	US 15 South, 2005	X	X	X
Cogan House Township	County	County	County	County
Cummings Township	County	County	County	County
Duboistown Borough	Greater Williamsport Alliance, 2005	X	X	X
Eldred Township	County	X	X	X
Fairfield Township	Montoursville-Muncy, 2005	X	X	X
Franklin Township	County	X	X	X
Gamble Township	County	County	County	County
Hepburn Township	Lower Lycoming Creek, 2005	X	X	X
Hughesville Borough	Muncy Creek 2004	X	County	X
Jackson Township	County	County	County	County
Jersey Shore Borough	US 220/Future I-99, 2005	X	County	X
Jordan Township	County	County	County	County
Lewis Township	Lower Lycoming Creek, 2005	County	X	County
Limestone Township	County	County	County	County
Loyalsock Township	Greater Williamsport Alliance, 2005 and Lower Lycoming Creek, 2005	X	X	X
Lycoming Township	Lower Lycoming Creek, 2005	X	X	X
McHenry Township	County	County	County	County
McIntyre Township	County	County	County	County
McNett Township	County	County	County	County
Mifflin Township	County	County	County	County
Mill Creek Township	County	X	County	X
Montgomery Borough	US 15 South, 2005	X	X	X
Montoursville Borough	Montoursville-Muncy, 2005	X	X	X

Table 5.2-1 Major Planning Tools in Lycoming County

Municipality	Comprehensive Land Use Plan	NFIP/FP Regulations	Subdivision Regulations	Zoning Regulations
Moreland Township	County	County	County	County
Muncy Borough	Muncy Creek, 2004	X	X	X
Muncy Creek Township	Muncy Creek, 2004	X	X	X
Muncy Township	Montoursville-Muncy, 2005	County	County	County
Nippenose Township	County	X	X	X
Old Lycoming Township	Greater Williamsport Alliance, 2005 and Lower Lycoming Creek, 2005	X	X	X
Penn Township	County	County	County	County
Piatt Township	US 220/Future I-99, 2005	County	County	County
Picture Rocks Borough	Muncy Creek, 2004	X	County	X
Pine Township	County	X	County	X
Plunketts Creek Township	County	X	X	X
Porter Township	US 220/Future I-99, 2005	X	County	X
Salladasburg Borough	County	County	County	County
Shrewsbury Township	Muncy Creek, 2004	X	County	X
South Williamsport Borough	Greater Williamsport Alliance, 2005	X	X	X
Susquehanna Township	County	X	X	X
Upper Fairfield Township	County	X	X	X
Washington Township	County	County	X	County
Watson Township	County	X	County	X
Williamsport, City of	Greater Williamsport Alliance, 2005	X	X	X
Wolf Township	Muncy Creek, 2004	X	X	X
Woodward Township	US 220/Future I-99, 2005	X	X	X

X = in place locally
County = Under County Ordinance

Emergency Operations Plan

The Pennsylvania Emergency Management Services Code, Title 35, requires all political jurisdictions in the Commonwealth to have an emergency operations plan (EOP), an emergency management coordinator (EMC), and an emergency operations center (EOC).

Lycoming County's EOP is an all-hazards plan that complies with the National Incident Management System (NIMS) and is the basis for a coordinated and effective response to any disaster that may affect lives and property in Lycoming County. The EOP, or portions thereof, would be implemented when emergency circumstances warrant it. All 52 municipalities have

local EOPs in place, though several municipalities need to update their EOPs to the most recent PEMA-approved format. The Lycoming County EOP was revised in April 2010.

Lycoming County's EOP is administered by the County's Department of Public Safety. It assigns responsibility to all response organizations, not only for training and preparedness, but also for response and recovery. Specific annexes, referred to as Emergency Support Function (ESF) documents, have been developed to address specific natural and technological hazards that may require an added level of coordination. A mitigation plan that is added as an addendum to an EOP can enhance the recovery process. In order to comply with the Pennsylvania Emergency Management Agency's (PEMA's) annual work plan, units of local government are required to prepare and submit a hazard vulnerability analysis, which identifies and assesses the community's risk to natural and human-induced hazards. The County of Lycoming's Hazard Vulnerability Analysis (HVA) was updated in 2009 and again in 2014 as part of this Plan's update process. Information gathered for the Hazard Mitigation Opportunity section if this document may prove valuable in enhancing the existing HVA.

The development of Marcellus Shale gas that requires drilling and use of water containing hazardous constituents, construction and maintenance of gas lines, and the movement of heavy equipment has created a suite of new hazards to be accounted for in emergency operations planning. Pennsylvania adopted Act 9 of 2012, mandating that DEP establish standards for well safety, and more specifically for emergency response for unconventional well sites. Lycoming County has an Emergency Response Plan for Unconventional Well Sites.

Continuity of Operations Plan

Continuity of Operations (COOP) is a critically important planning principle for emergency managers as well as for municipal officials. The National Fire Protection Association's *Standard on Disaster/Emergency Management and Business Continuity Programs* (NFPA 1600) provides those with the responsibility for disaster and emergency management and COOP planning programs with the criteria to assess current programs or to develop, implement, and maintain a program to mitigate, prepare for, respond to, and recover from disasters and emergencies.

The County of Lycoming Court of Common Pleas has developed a COOP plan that identifies alternative sites for courts and magistrates to conduct operations in the event the County courthouse is not accessible or is damaged due to man-made or natural disaster. The plan, with an effective date of November 1, 2007, also addresses delegation of authority, order of succession, and essential functions.

Evacuation Plan

Evacuation is one of the most widely used methods of protecting the public from hazard impacts. The easiest way to minimize death and injury due to a hazard event is to remove as many people as possible from its path. Evacuation plans include descriptions of the area(s) being evacuated, the demographics and characteristics of people within those area(s), transportation routes to safe areas, and how the community will support those individuals who do not have access to their own transportation. The County EOP noted above addresses various evacuation situations, such as evacuation plans for dam safety, hazardous material

spills, and radiation releases. Emergency Action Plans developed for dams contain evacuation plans, and each municipality's EOP includes identification of traffic and access control points.

Disaster Recovery Plan

A Disaster Recovery Plan (DRP) is a comprehensive set of measures and procedures that ensure essential, mission-critical resources and infrastructure are maintained or backed up by alternatives during various stages of a disaster. The DRP is another step to ensure the preparedness and ability to respond quickly and effectively to restore the community's essential services. The DRP addresses the public sector's responsibilities, including temporary shelter, refuse disposal, overall damage assessment, restoration of utility services, reconstruction priorities, financial assistance, and dealing with emergency demands. In Lycoming County the DRP is a component of the EOP.

During disasters, the Lycoming County Planning and Community Development Department staff has a supporting role in staffing the EOC to coordinate information, supply transportation information, coordinate housing efforts for disaster victims, and conduct public damage assessment.

StormReady

StormReady is a program administered by the National Weather Service (NWS). To be certified as StormReady, a community must establish links to the NWS's warning systems and relationships with NWS staff, establish a 24-hour warning point, ensure sufficient capability to respond to severe weather events, and provide public outreach and education.

The County of Lycoming was certified as Storm Ready in 2000 under this national program. In 2009 Lycoming County renewed its Storm Ready Community designation with the NWS and PEMA officials from Central Region. This entailed a thorough inspection of numerous documents and file information by the NWS.

The County also plans on implementing two Skywarn training classes offered by the NWS and implementing a yearly damage assessment/reporting class related to the adverse weather training and preparation system offered by PEMA.

5.2.1. Planning and Regulatory Capability

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

Municipalities implement land use controls via the adoption and enforcement of zoning, subdivision and land development ordinances, building codes, building permit ordinances, floodplain, and/or 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.

Hazard Mitigation Plan

Hazard mitigation plans (HMPs) such as this 2015 HMP Update, describe in detail the hazards that may affect the community, the community's vulnerability to those hazards, and an action plan for how the community plans to minimize or eliminate that vulnerability. HMPs are governed by the Disaster Mitigation Act of 2000 (DMA 2000), and having a FEMA-approved HMP makes the jurisdiction eligible for federal mitigation funding.

Comprehensive Plans, Building Codes, Zoning, and Subdivision Regulations

A comprehensive plan is a policy document that states objectives and guides the future growth and physical development of a municipality. The comprehensive plan is a blueprint for housing, transportation, community facilities, utilities, and land use. It examines how the past led to the present and charts the community's future path. 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.

With regard to hazard mitigation planning, Section 301(a)2 of the MPC requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the Plan give consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services, and recommends giving consideration to storm drainage and floodplain management. The Lycoming County Comprehensive Plan was adopted in 2006.

There are also six multi-municipal regional plans designed to address specific issues and characteristics of the following areas within the County: Muncy Creek area, Montoursville/Muncy area, US 220/I-99 corridor, US 15 corridor, Greater Williamsport Alliance, and Lower Lycoming Creek. Hazards such as floodplains and steep slopes were critical issues impacting on all of these plans.

All municipalities are covered, in some capacity, under one or more comprehensive plans adopted by the County of Lycoming. The following is a link to the comprehensive plans available via the County's home page:
http://www.lyco.org/dotnetnuke/Home/PlanningandCommunityDevelopment/ComprehensivePlans/tabid/310/Default.aspx

Floodplain Management Plan

Floodplain management plans describe how the community will reduce the impact of flood events through preventive and corrective actions. These actions may include mandated open space and prohibition of development in floodplains, property buyout, and other measures. All 52 municipalities in Lycoming County administer their floodplain management ordinances

through their zoning programs. Municipalities that participate in the County Zoning Partnership have their floodplain ordinances administered by the County Zoning Administrator.

Open Space Management Plan (or Parks/Rec or Greenways Plan)

Open space management plans are designed to protect the natural environment of the community. They describe how the community will manage woodlands, grasslands, and trails without sacrificing the economic goals of the community. These areas are most widely used for recreational purposes, but also serve as the primary habitat for a number of species of plants and animals.

Lycoming County adopted a Recreation, Parks, and Open Space/Greenway Plan in the spring of 2008. Fifteen municipalities indicated that they have open space plans.

Stormwater Management Plan/Ordinance

The proper management of stormwater runoff can improve conditions and decrease the chance of flooding. Thirteen municipalities indicated they have developed local stormwater management ordinances. These ordinances were developed in conjunction with the guidelines established in the Pennsylvania Stormwater Management Act (Act 167 of 1978).

The Pennsylvania Department of Environmental Protection's Stormwater Management Program provides grant moneys to counties to develop stormwater management plans for designated watersheds. This planning effort, as required by the Stormwater Management Act of 1978 (Act 167), 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-to-site or municipal boundary basis. Municipalities within the same watershed may require different levels of control of stormwater. The result is often the total disregard of downstream impacts or the compounding of existing flooding problems.

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

The Department of Planning and Community Development reports that all 52 municipalities have adopted the Lycoming County Stormwater Management Plan dated May 6, 2010.

Natural Resource Protection Plan

Natural resource protection plans are designed to protect woodlands, steep slopes, waterways, floodplains, wetlands, and coastal buffers through prohibiting or severely limiting development in these areas. Emergency managers and community planners have been made more and more aware of the benefits of protecting these areas as mitigation measures over the last few decades. Natural resource protection is covered in the Recreation, Parks, and Open Space/Greenway Plan (2008), the County Comprehensive Plan, and multi-municipal regional plans.

Flood Response Plan

These plans describe how a community will respond to flood events. They include warning the public, evacuation and sheltering, emergency response, recovery, and mitigation of future events. Most communities in Pennsylvania have moved away from planning for individual hazards and now include flood response as part of their all-hazards EOPs. This issue is addressed in the Lycoming County EOP.

Capital Improvement Plan

The capital improvement plan is a multiyear policy guide that identifies needed capital projects and is used to coordinate the financing and timing of public improvements. Capital improvements relate to streets, stormwater systems, water distribution, sewage treatment, and other major public facilities. A capital improvement plan should be prepared by the respective county's planning commission and should include a capital budget. This budget identifies the highest priority projects recommended for funding in the next annual budget. The capital improvement plan is dynamic and can be tailored to specific circumstances. According to the survey, only six municipalities responded that they have a capital improvement plan.

Lycoming County has identified the following capital improvement projects as important in hazard mitigation planning:

- EOC expansion: near-term
- Communication Towers replacement: near-term
- Montoursville Levee: mid-term
- Lower Lycoming Creek mitigation: long-term
- Maintain or improve Williamsport Flood Protection Project compliance rating with US ACE: long-term

Economic Development Plan

An economic development plan serves as a road map for economic development decision making, based on the collection of statistical data, historical perspective, and human potential, and it does the following:

- Clearly defines realistic goals and objectives
- Establishes a defined time frame to implement goals and objectives
- Communicates those goals and objectives to the organization's constituents
- Ensures effective use of the organization's resources
- Provides a baseline from which progress can be measured

- Builds consensus around future goals and objectives

The County Comprehensive Plan and the six regional multi-municipal comprehensive plans have sections addressing economic development.

Historic Preservation Plan

These plans describe how the community will preserve the historic structures and areas within it. Since these structures pre-date building codes and modern community planning requirements, many of them are especially vulnerable to a variety of hazards. A historic preservation plan may include measures to retrofit or relocate historic treasures out of hazard impact areas. Five municipalities have indicated that they have historic preservation plans.

Floodplain Regulations

Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures in the 1% chance floodplain are engineered to minimize the impact of flooding and are better able to withstand the forces of a 1% chance flood event. By following floodplain regulations, citizens are not only living in safer buildings but will have lower flood insurance premiums due to NFIP-compliant construction practices.

All 52 municipalities in Lycoming County have enacted floodplain ordinances and will be updating their floodplain management ordinances as part of the current RiskMAP process taking place now. The following municipalities participate in the County Zoning Partnership:

- Bastress Township
- Brown Township
- Cascade Township
- Cogan House Township
- Cummings Township
- Gamble Township
- Jackson Township
- Jordan Township
- Lewis Township
- Limestone Township
- McHenry Township
- McIntyre Township
- McNett Township
- Mifflin Township
- Moreland Township
- Muncy Township
- Penn Township
- Piatt Township
- Salladasburg Borough
- Washington Township

The County's zoning ordinance exceeds federal requirements for floodplain management by:

- prohibiting the conversion, improvement, expansion or construction of mobile home parks, hospitals, nursing homes, jails, or prisons;
- prohibiting all construction within the floodway, except for public improvements that would not increase the base flood elevation (BFE);
- requiring one and one-half feet of freeboard for all new construction or substantial improvement of residential structures within the floodplain; non-residential structures must be flood proofed;

- prohibiting fully enclosed structures (basements) below freeboard and requiring partially enclosed structures to allow for the movement of floodwaters and the stabilization of exterior walls;
- requiring the elevation of critical mechanical utilities above the freeboard and elevation where possible of non-critical utilities;
- prohibiting the storage of hazardous materials and substances in excess of 550 gallons in the floodplain.

Zoning Regulations

Article VI of the MPC authorizes municipalities to prepare, enact, and enforce zoning to regulate land use. Its regulations can apply to the following:

- Permitted use of land
- Height and bulk of structures
- Percentage of a lot that may be occupied by buildings and other impervious surfaces
- Yard setbacks
- Density of development
- Height and size of signs

Zoning ordinances contain both a map that delineates zoning districts and text documenting the regulations that apply in each zoning district. Lycoming County has adopted a county zoning ordinance that covers municipalities that do not have their own ordinance. Twenty-nine municipalities have adopted local zoning ordinances while the remaining.

The County Partnership Zoning Ordinance covers specifics relating to floodplain management, wind energy development, airport hazard areas, steep and severe slopes, carbonate geology, and woodland protection (wildfire prevention standards).

Subdivision Regulations

Article V of the MPC authorizes municipalities to prepare, enact, and enforce a subdivision and land development ordinance, including regulations to control the layout of streets, minimum lot sizes, and the provision of utilities. The objectives of a subdivision and land development ordinance are to do the following:

- Coordinate street patterns
- Ensure that adequate utilities and other improvements are provided in a manner that will not pollute streams, wells, and/or soils
- Reduce traffic congestion
- Provide sound design standards as a guide to developers, elected officials, planning commissions, and other municipal officials

The Lycoming County Planning Commission has the authority to approve, approve with conditions, or disapprove all subdivisions and land developments that occur in municipalities that do not have an ordinance.

In cases where municipalities have their own subdivision and land development ordinance, plans must be submitted to the County Planning Commission for review, and the Planning Commission provides comments to the municipality within 30 days. Municipalities in Lycoming County with an ordinance are listed in Table 5.2.1.

Unified Development Ordinance

Unified development ordinances combine all other development ordinances (e.g., subdivision management, zoning) into a single document reflecting the community's vision for its development. Combining these documents helps to rectify any discrepancies among them which may be due to the individual documents being required by separate legislation.

Post-Disaster Redevelopment/ Reconstruction Ordinance

These ordinances are passed by proactive communities that recognize the complexities of post-disaster recovery. They describe the organization of the redevelopment oversight body, damage assessment, and recovery policies related to making the community more sustainable and safer following a disaster. Seven of the 52 municipalities indicated that they have such an ordinance.

Building Code

Building codes are important in mitigation, because codes are developed for regions of the country in consideration of the hazards present within that region. Consequently, structures that are built to applicable codes are inherently resistant to many hazards such as strong winds, floods, and earthquakes, and can help mitigate regional hazards like wildfires. In 2003, the Commonwealth of Pennsylvania 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.

If a municipality has "opted in," all UCC enforcement is local, except where municipal (or third party) code officials lack the certification necessary to approve plans and inspect commercial construction for compliance with UCC accessibility requirements. If a municipality has "opted out," the Department of Labor and Industry is responsible for all commercial code enforcement in that municipality. The Department of Labor and Industry also has sole jurisdiction for all state-owned buildings no matter where they are located.

Local residential and nonresidential code officials were required to register and obtain certification within three and five years, respectively. While some municipalities in Lycoming County had already instituted building codes prior to the mandate by the Commonwealth, all municipalities and the County have spent considerable time and resources retraining and becoming certified in the new requirements and revamping their administrative and enforcement procedures. With the exception of three municipalities, Cummings, Gamble, and McHenry, all

other municipalities have opted in. Except for the City of Williamsport and Loyalsock Township, municipalities in Lycoming County have hired a third-party contractor to enforce building codes.

Fire Code

Fire codes relate to both the construction and use of structures in terms of preventing fires from starting and minimizing their spread, and minimizing the injuries and deaths caused by a fire within a building. They govern such things as the following:

- Building materials that may be used
- The presence and number/type of fire extinguishers
- Means of egress
- Hazardous materials storage and use
- Sixteen municipalities indicated that they have fire codes.

Firewise

Firewise is a national program that brings together the response community, community planners, and homeowners to minimize the risk of wildfires. The program focuses on development that is compatible with the natural environment. Participation in the program is begun and maintained by groups of homeowners. Five municipalities indicated they participate in the Firewise program.

Lycoming County assists communities in the establishment of a Firewise community rating for the local municipality in cooperation with the Department of Conservation and Natural Resources Bureau of Forestry. The Tanker Task Force is also part of this initiative. The County also provides resource for training through the Bureau of Forestry and community colleges.

Farmland Preservation

Farmland preservation measures are important to hazard mitigation. Preserved farms protect soil from erosion and prevent the contamination of local surface water. In addition, farms and forest land are important for recharging the community's aquifer and providing habitat for local wildlife. Lycoming County has a very active agricultural land preservation program overseen by a seven-member board. The County Conservation District administers the program.

Act 537 Sewage Facilities Planning

Pennsylvania Act 537, the Sewage Facilities Planning Act, requires municipalities to develop and implement comprehensive official plans that provide for the resolution of existing sewage disposal problems, provide for the future sewage disposal needs of new land development, and provide for the future sewage disposal needs of the municipality. This planning process is designed to protect the health, welfare, and safety of all Pennsylvanians by protecting the Commonwealth's water resources. While these plans are designed to manage health risks, the planning process associated with keeping these plans current and applicable requires consideration of how local hazards may impact on a community's ability to implement these plans in a cost-effective manner. Some hazards that can affect the sewage facilities planning process and implementation include flooding, drought, and terroristic sabotage. In Lycoming

County the key issue of concern is flooding and how it impacts various wastewater treatment plants (WWTPs) and planned expansions.

Lycoming County has seven WWTPs. In recent years, the nutrient reduction mandates associated with the Chesapeake Bay cleanup, and consent orders relating to Combined Sewer Overflows (CSO) and Inflow and Infiltration (I&I) problems, have placed renewed attention on the condition of wastewater infrastructure in the County. Two of the plants, Lycoming County Water and Sewer Authority (LCWSA) and Hughesville-Wolf Authority (HWA), are relatively new, modern WWTPs that are located in secure areas not threatened by flooding. The two plants operated by the Williamsport Sanitary Authority (WSA) are located behind the City's levees and are thus protected from flood hazards. However, three of the County's plants located in borough population centers are at significant risk of flooding. Fortunately, all three of these plants are currently undergoing planning to reduce hazard exposure. The Jersey Shore Borough plant will be closed down in the coming years and a new plant built out of the floodplain. The Borough of Montgomery is also considering upgrading its plant and considering possible regional solutions.

In addition to the County's WWTPs, the community collection systems that serve as tributaries to the WSA plants (Loyalsock and Old Lycoming Townships, and South Williamsport and Duboistown Boroughs), are being upgraded to reduce the I&I conditions that currently contribute to the CSO problem in the City of Williamsport.

Erosion and Sedimentation Control

The Pennsylvania Department of Environmental Protection (PA DEP) Rules and Regulations Chapter 102: Erosion and Sediment Control requires persons proposing or conducting earth disturbance activities to develop, implement, and maintain Best Management Practices (BMPs) to minimize the potential for accelerated erosion and sedimentation. The BMPs are designed to protect, maintain, reclaim and restore water quality of Commonwealth waters in order to protect the health, welfare, and safety of all Pennsylvanians.

Section 102.5 requires that permits be issued by the PADEP for certain earth disturbance activities that exceed certain threshold levels depending on the type of activity. Steep slopes, sinkholes, and hazardous materials are examples of some hazards that may be an integral consideration in the permit application review process. In many instances the program is administered by the County Conservation District. In Lycoming County, the Conservation District does administer the program.

The County Conservation District has always been a very critical partner in the management and protection of natural resources so critical to the economic health of Lycoming County. The Conservation District is in the forefront of efforts to implement BMPs that will protect local waterways and the Chesapeake Bay. Floodplain restoration is one very interesting BMP that is being looked at since it not only can reduce erosion that contributes nutrient loads to the waterways, but can also reduce flooding hazards.

Drought Planning

Under management of the Lycoming County Department of Public Safety, the County maintains a drought task force to deal with drought emergencies. Included in its review is maintenance of the Tanker Task Force, up-to-date listing of water surveys, and list of well drilling companies.

Coroner's Office Response Planning

The Coroner's office has developed a response plan for disasters involving mass casualties. The Susquehanna Health System and the County of Lycoming have invested over $220,000 to develop the forensic center located at the Williamsport Hospital Campus. The forensic center houses the morgue area for providing autopsy services, dental x-ray equipment for providing dental identification services, a family viewing area, office space, radio and telephone communications equipment, and a 13′ x 16′ refrigerated cooler with a capacity of approximately 20 decedents. Muncy Valley Hospital has refrigeration to hold two decedents. Additional refrigerated decedent holding areas throughout the County include space for four at Spitler Funeral Home, three at Maneval Funeral Home, and four at McCarty Thomas Funeral Home. In the event the need for space exceeds the 44 available spaces, there is a regional response plan to make regional resources available or to bring in refrigerated trucks. The local plan is coordinated by the County of Lycoming Coroner, and the regional response would be coordinated by the Pennsylvania State Coroners Association president and regional vice presidents

Participation in the National Flood Insurance Program (NFIP)

The Pennsylvania Floodplain Management Act (Act 166 of 1978) requires every municipality 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. All 52 municipalities participate in the NFIP.

Lycoming County Department of Planning and Community Development produced a video in 2014 for Lycoming County Area Television (LCAT) that describes the RiskMAP process and provides information on flooding, Stream Gauge System, elevation certification, and flood mitigation. The video will be available on the Flood Ready website and will be released on social media.

National Flood Insurance Program – 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.

Jersey Shore Borough (CRS Class 9) and Loyalsock Township (CRS Class 10, rescinded) are the only municipalities participating in this program. Input provided during the mitigation solutions workshop indicates that the administrative documentation procedures and their associated costs may be a hindrance to municipalities in using this program.

5.2.2. Administrative and Technical Capability

Planners with knowledge of land development/management practices

County Planning Department

In Pennsylvania, planning responsibilities traditionally have been delegated to each county and local municipality through the municipal planning commission (MPC).

A planning agency acts as an advisor to the governing body on matters of community growth and development. A governing body may appoint individuals to serve as legal and engineering advisors to the planning agency. In addition to the duties and responsibilities authorized by Article II of the MPC, a governing body may, by ordinance, delegate approval authority to a planning agency for subdivision and land development applications. A governing body has considerable flexibility, not only as to which powers and duties are assigned to a planning agency, but also as to what form an agency will possess. A governing body can create a planning commission, a planning department, or both.

The purpose of the Lycoming County Planning and Community Development Department is to receive and make recommendations on public and private proposals for development, and to prepare and administer planning regulations. Subdivision and land development plans are also reviewed and approved by the Lycoming County Planning and Community Development Department, which works in conjunction with the municipal planning commissions, where applicable. Lycoming County Planning and Community Development Department activities and continuous education of commission members is very serious business in this County. The County supports training for members by covering the costs for attendance at training sessions and attendance at state and national planning conferences. The development of the Lycoming County Comprehensive Plan and the six multimunicipal plans facilitated an environment of collaboration between the County Planning and Community Development Department and the local municipalities that has now resulted in more coordination between local planning initiatives and County planning initiatives.

Municipal Planning Commission

The MPC conveys the planning authority and establishes the requirements that a municipality must follow. 31 municipalities indicated that they have planners with appropriate knowledge of land development and management practices.

Engineers or professionals trained in construction practices related to buildings and/or infrastructure (includes building inspectors)

A municipal engineer performs duties as directed in the areas of construction, reconstruction, maintenance, and repair of streets, roads, pavements, sanitary sewers, bridges, culverts, and other engineering work. The municipal engineer reviews and/or prepares plans, specifications, and estimates of the work undertaken within the municipality. All 52 municipalities have contracted with a private engineer for consultation in this area.

Planners or engineers with an understanding of natural and/or human-caused hazards

When staff who are responsible for community planning or engineering the structures on which people rely are familiar with the hazards that can impact the community, there is a great potential for synergy. These staff members will design the communities and structures with hazard impacts in mind, resulting in more sustainable communities and stronger structures. Twenty-eight municipalities responding 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 Department will provide consultation in many facets of planning and employ a hazard reduction planner whose focus is the mitigation of natural hazards. The County's Department of Public Safety functions in much the same way.

Emergency manager

A municipal emergency management coordinator (EMC) is responsible for emergency management – preparedness, response, recovery, and mitigation within his/her respective Authority Having Jurisdiction (AHJ). The responsibilities of the EMC are outlined in the Pennsylvania Code, Title 35 §7503:

- Prepare and maintain a current disaster emergency management plan

- Establish, equip, and staff an emergency operations center (EOC)
- Provide individual and organizational training programs
- Organize and coordinate all locally available manpower, materials, supplies, equipment, and services necessary for disaster emergency readiness, response, and recovery
- Adopt and implement precautionary measures to mitigate the anticipated effects of a disaster
- Cooperate and coordinate with any public and private agency or entity
- Provide prompt information regarding local disaster emergencies to appropriate Commonwealth and local officials or agencies and the general public
- Participate in all tests, drills, and exercises, including remedial drills and exercises, scheduled by the applicable agency or by the federal government

All 52 municipalities in Lycoming County have EMCs. It is not uncommon that one EMC covers multiple municipal jurisdictions.

Floodplain manager

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. All 52 municipalities participate in the NFIP and have a designated Floodplain Manager. Those municipalities that are under the County Zoning Ordinance utilize the County Floodplain Manager.

Land surveyors

Land surveyors determine, among other things, the elevation of a given point (e.g., a structure). This is especially useful in determining what development lies in the floodplain, but can also be useful in examining vulnerability to other hazards as well. Seven municipalities indicated that they do have this technical resource capability.

Scientist familiar with the hazards of the community

Natural and human-made hazards' characteristics and impacts can be highly technical. Meteorology, aerodynamics, fluid dynamics, physics and health physics, chemistry, and several other scientific fields are involved in determining the impacts of a hazard event. Having access to a scientist who can describe the technical aspects of hazards in lay terms is important to having a sound mitigation strategy. Only three municipalities reported that they have access to this technical capability. However, the Pennsylvania College of Technology, an affiliated institution of Penn State University, is located in Williamsport. It could provide significant academic support by offering related programs in the following: architectural technology, residential construction technology, building construction technology, construction management, civil engineering technology, forest technology, and landscape architecture technology. The Clean Water Institute at Lycoming College is another resource (see http://www.lycoming.edu/biologydept/cwi/).

Staff with the education or expertise to assess the community's vulnerability to hazards

The basis of hazard mitigation is hazard identification and vulnerability assessment. Conducting the vulnerability assessment is a complicated process. Planners must know where to find data on the hazards and their impacts and the characteristics of the community. More importantly, they must be able to combine these two sets of knowledge to make the analysis useful. Twenty-five municipalities responded that this capability is addressed. However, the Lycoming County Department of Planning and Community Development has a hazard reduction planner on staff who can provide this expertise.

Personnel skilled in Geographic Information Systems (GIS) and/or FEMA's HAZUS program

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. Lycoming County has GIS capabilities that can assist the municipalities. The County has a very sophisticated and comprehensive system database and is undertaking various initiatives to make GIS more accessible and useable by local municipalities. The County also makes available GeoPlan, a GIS based municipal management tool to municipalities and authorities. In addition, all of the municipalities in the County Zoning Partnership use GeoPlan. The County also makes available to Fire, EMA and Police Departments across the County a GIS DVD of the County.

Resource development staff or grant writers

Few communities have the financial resources that are required to implement all of their potential programs (e.g., mitigation measures). Therefore, they must rely on grants and other fundraising opportunities to obtain the money necessary to perform mitigation projects. Many grants are competitive, and individuals can provide donations to a vast array of causes, so the community must demonstrate that it can use those funds better than other applicants. This may be difficult, but having a specialist on staff will likely increase the community's chances of receiving funding. The Lycoming County Department of Planning and Community Development often provides assistance on grant writing, especially when it involves multi-municipal initiatives.

Fiscal staff to handle large/complex grants

Many of the funding streams that can be used for hazard mitigation have substantial management and reporting requirements. Employing or having access to staff specializing in grants management will help the community ensure that it does not lose a grant opportunity because it did not meet the administrative requirements of that grant. While only 13 municipalities noted this capability in the survey, Lycoming staff is well versed in grants management and provides assistance to local municipalities.

5.2.3. Financial Capability

Fiscal 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 a large number of programs, including streets, 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. The result has been a growing interest in "creative financing." The following information pertains to various financial assistance programs pertinent to hazard mitigation.

Capital improvement programming

Most capital improvement projects involve the outlay of substantial funds, and local government can seldom budget for these improvements in the annual operating budget. Therefore, numerous techniques have evolved to enable local governments to finance for capital improvements over a time period exceeding one year. Public finance literature, and state laws governing local government finance, classify techniques that are allowed to finance capital improvements. These techniques include revenue bonds; lease-purchase, authorities, and special districts; current revenue (pay-as-you-go); reserve funds; and tax increment financing.

Some projects may be financed with general obligation bonds. With this method, the jurisdiction's taxing power is pledged to pay interest and principal to retire debt. General obligation bonds can be sold to finance permanent types of improvements, such as schools, municipal buildings, parks, and recreation facilities. Voter approval may be required. See section 5.2.3.8 of this Plan, the Capital Improvement Plan section, for additional information. Eleven municipalities indicated that they do have capital improvement programming.

Municipal Authorities

Municipal authorities are most often used when major capital investments are required. In addition to sewage treatment, municipal authorities have been formed for water supply, airports, bus transit systems, swimming pools, and other purposes. Municipal authorities have powers to receive grants, borrow money, and operate revenue-generating programs, and are authorized to sell bonds, acquire property, sign contracts, and take similar actions. Authorities are governed by authority board members who are appointed by the elected officials of the member municipalities. Lycoming County and its municipalities have numerous special purpose authorities dealing with such things as water and sewer infrastructure, industrial development, and housing.

Community Development Block Grants (CDBGs)

These grants are designed to assist the 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 following are entitlement communities:

- Central cities of Metropolitan Statistical Areas (MSAs)
- Cities with at least 50,000 people
- Some urban counties with at least 200,000 people
- States provide CDBG funds to non-entitlement jurisdictions.

The majority of CDBG funds are required to be spent to benefit low- and moderate-income people. Also, there is a set of national objectives for the program, including addressing existing conditions that pose a threat to the health and welfare of the community (e.g., low-income housing in a floodplain). All municipalities within Lycoming County have access to CDBG funding, be it directly through the federal or state government or through a competitive county selection process.

To date, CDBG funding has not been allocated to hazard mitigation projects in Lycoming County however the County is partnering with Success Through Engagement Parnerships (STEP) to pursue grant funding through CDBG-DR for a housing rehabilitation project that will involve primary homeowner occupied residences affected by tropical storm Lee. If funding is granted, the project will involve elevations, utility retrofits, and possibly some new construction/additions.

Special purpose taxes

Communities may exercise their taxing authority to raise funds for any project they see fit. This includes special taxes to fund mitigation measures. Spreading the cost of a community project among the community's taxpayers helps provide the greatest public good for relatively little individual cost. Special purpose taxes can take the form of fees associated with development such as ACT 13, which is described in greater detail in the "Development impact fees" section.

Gas/electric utility fees

In the same way that special taxes can be levied to fund mitigation projects, another avenue for financing a project that a community may utilize is to dedicate a portion of homeowners' gas and electric utilities fees to upgrade and maintain the related infrastructure. Burying transmission lines, thereby mitigating from the effects of winds and ice storms, is expensive. These fees help to offset that cost. Only Fairfield Township reported using this approach.

Water Authorities and Fees

Water authorities are multipurpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to the municipality is among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage. The cost of 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. The PADEP has a program to assist with consolidation of small individual water systems to make system upgrades more cost effective.

Sewer Authorities and Fees

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. In areas with no public water supply, flat rate charges are calculated on average use per dwelling unit.

There are five sewer authorities operating in Lycoming County, including the Williamsport Sanitary Authority, Montgomery Sewer Authority, Lycoming County Water and Sewer Authority, Muncy Borough Municipal Authority, and the Hughesville-Wolf Township Municipal Authority. These five authorities, in partnership with the Jersey Shore Borough WWTP, local municipalities, and Lycoming County, are working on regional cooperation efforts to manage in a cost-effective manner sewage facilities infrastructure upgrades.. A key objective of this effort involves the elimination of WWTPs from the floodplain. In addition there are seven public water supply authorities, including Hughesville – Wolf Joint Municipal Authority, Jersey Shore Area Joint Water Authority, Lycoming County Water and Sewer Authority, Montgomery Water and Sewer Authority, Muncy Borough Municipal Authority, Williamsport Municipal Water Authority, and Woodward Township Water and Sewer Authority. Detailed information can be found in the 2001 Lycoming County Water Supply Plan at http://www.lyco.org/Portals/1/PlanningCommunityDevelopment/Documents/EDPS_PDFs/WSP_Final_Report.pdf.

Stormwater utility fees

Stormwater utility fees are assessed and collected to offset the cost of maintaining and upgrading stormwater management structures such as drains, retention ponds, and culverts. No municipalities were identified as using this approach in Lycoming County.

Development impact fees

Development impact fees are one-time fees assessed to offset the cost of providing public services to a new development. In Pennsylvania, impact fee programs may be established for capital improvements associated with transportation infrastructure in accordance with section 505-A of the Pennsylvania Municipalities Planning Code and the Pennsylvania Transportation Partnership Act. This program would allow for investments in highway infrastructure to reduce hazard risks. In addition, Pennsylvania Act 203 of 1990: Municipalities Authorities Act Amendments, allows water and sewer authorities to charge tapping fees for infrastructure improvements to connect adjacent properties to systems. However, this authorization would only have limited value in addressing hazards. In other states, such impact fees may be dedicated to providing the related new water or sewer infrastructure, roads, parks and recreational areas, libraries, schools, etc. The new infrastructure may be less vulnerable to hazard impacts.

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. For example, oil and gas well pad setbacks from private water wells, streams, and buildings increased; bond amounts for catastrophic accidents increased; and public accessibility of information related to chemicals used onsite improved (Pittsburg Post-Gazette, 2012). A portion of the impact fees goes 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 in order to address statewide issues (PA PUC, 2012). A portion of the impact fees goes 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.

Lycoming County has proposed to use Act 13 funds to help construct a flood control structure in partnership with the Township of McIntyre, which would provide flood protection to the Village of Ralston and South Ralston. Under the proposed agreement, the county would cover a portion of the project cost. The project is currently on hold until additional funding becomes available.

General obligation, revenue, and/or special tax bonds

Jurisdictions may simply decide to dedicate general fund or similar financing to implement hazard mitigation projects. Eleven of the municipalities surveyed indicated they have such capabilities.

Partnering arrangements or intergovernmental agreements

Intergovernmental cooperation is one manner of accomplishing common goals, solving mutual problems, and reducing expenditures. The 52 municipalities within Lycoming County comprise 10 boroughs and 42 townships. Each of these municipalities conducts its daily operations and provides various community services according to local needs and limitations. Some adjacent municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide services such as police protection, fire and emergency response, infrastructure maintenance, and water supply management. Other municipalities have chosen to operate on their own. Each municipality varies in staff size, resource availability, fiscal status, service provision, constituent population, overall size, and vulnerability to the identified hazards. Twenty-three municipalities indicated they have such arrangements or agreements.

Lycoming County has cooperative agreements with several municipalities to administer their zoning and subdivision and land development ordinances (see Table 5.2.1). Numerous municipalities have cooperative agreements for mutual fire and police response.

Circuit Rider Program (Engineer)

The Circuit Rider Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join together to accomplish a common goal. The Circuit Rider is a municipal engineer or other form of professional who serves several small municipalities simultaneously. These are municipalities that may be too small to hire such a professional assistant for their own operations, yet need the skills and expertise the circuit rider can offer. Municipalities can jointly obtain what no single municipality could obtain on its own.

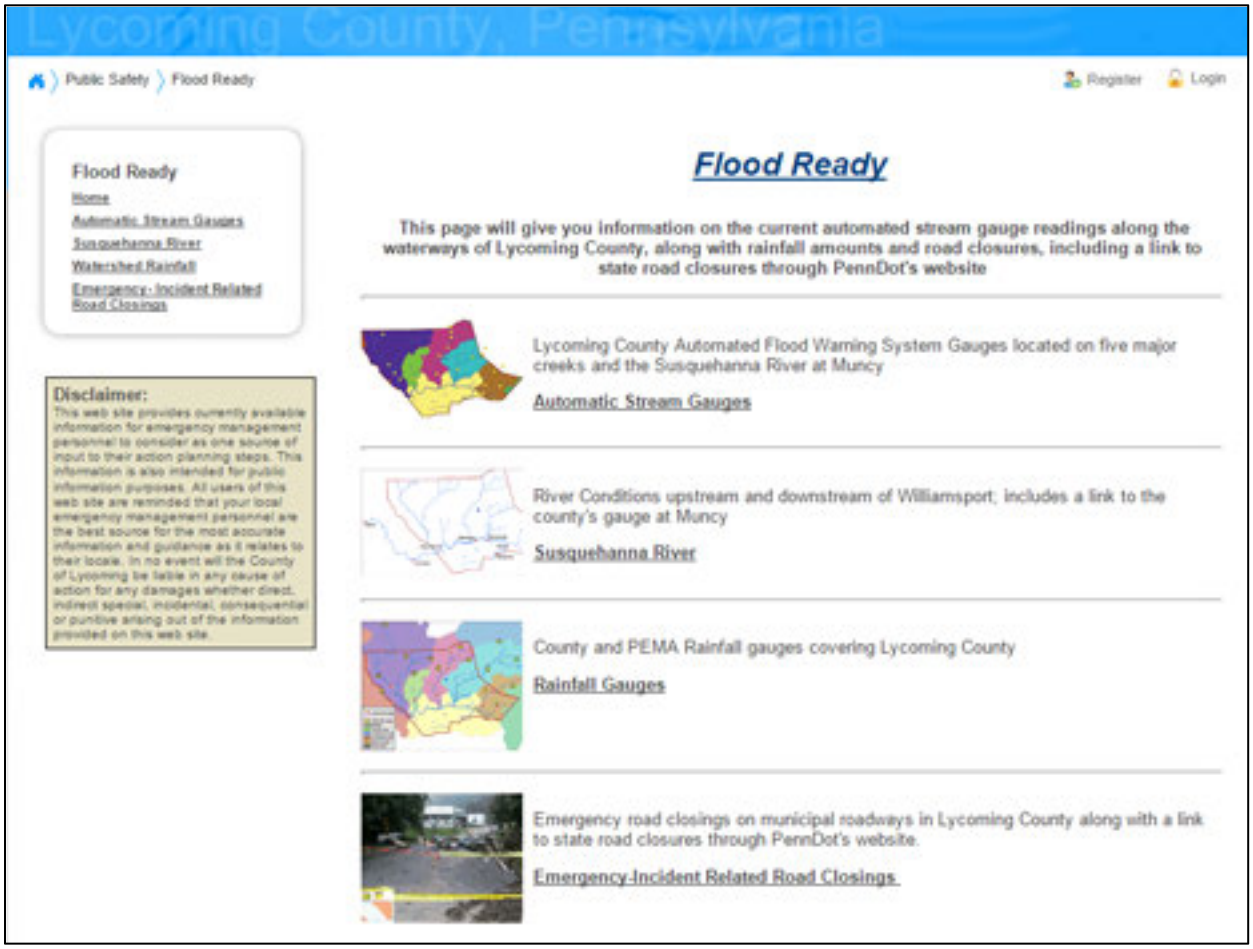
5.2.4. Education and Outreach

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.

Flood Ready is a webpage on the County website that provides local officials and residents with current stream and rainfall gauge information, emergency road closings along with a link to PennDOT District 3-0 traffic information. The website allows for the timely delivery of information that has the potential to inform and protect first responders, residents and business owners from adverse events. For example, the public can use the site to better understand safe travel routes in the event of an emergency or storm event by viewing the state and municipal road closures in the county. The portal also provides access to real-time data on precipitation levels and stream heights that can provide advance warning in the event of flooding.

At the height of the thunderstorm Lee the Flood Ready website had 83,869 hits before crashing on September 8, 2011. Normal site traffic ranges from 300 to 500 hits per month and is typically utilized by outdoorspeople such as fisherman and kayakers.



NOAA Weather-Ready Nation (WRMN) Ambassador is a designation that Lycoming County has achieved which recognizes NOAA partners that are improving resilience against extreme weather events. Partners help unify efforts across government, non-profits, academia, and private industry toward making the community and the nation more ready. According to NOAA, Ambassadors:

- Promote Weather-Ready Nation messages and themes to their stakeholders;
- Engage with NOAA personnel on potential collaboration opportunities;
- Share their success stories of preparedness and resiliency;
- Serve as an example by educating employees on workplace preparedness

NOAA supports Ambassadors by:

- Providing outreach content about creating a Weather-Ready Nation;
- Exploring innovative approaches for collaboration;
- Assisting with StormReady/TsunamiReady opportunities

Lycoming Parcel Viewer allows users to map parcel, floodplain, soil, and zoning information among other things, from the County website at http://lycomap.lyco.org/.

Lycoming County Department of Public Safety maintains a Gas Well/Energy Development Information page that includes vehicle identification, rescue/response guidance, and important industry related terms and definitions at http://www.lyco.org/PublicSafety/GasWellEnergyDevelopmentInformation.aspx.

The Lycoming County Emergency Management Agency coordinates and supports the following programs:

- Emergency Operations Planning for all 52 municipalities
- Fire Training Courses for all County Emergency Responders
- Specialized training for Municipal EMA Coordinators
- Emergency planning assistance to public, private and government agencies
- Drought Management Task Force
- Flash Flood Warning volunteer program
- Auxiliary Communications Service volunteer amateur radio program
- Radiological Emergency Response volunteer program
- Firefighting Foam Bank administration

- SKYWARN weather observation volunteer program
- National Weather Service assistance and cooperation
- Project Impact support
- Damage Assessment program
- Emergency Alert System Warning Program

5.2.5. Plan Integration

Lycoming County Comprehensive Plan

The Lycoming County Planning and Community Development Department is responsible for maintaining and updating the County Comprehensive Plan and the County Subdivision and Land Development Ordinance. The Planning Commission meets monthly to review, discuss, and comment on municipal subdivision and land development plans. It uses this information to identify necessary revisions and to amend both the Comprehensive Plan and the Subdivision and Land Development Ordinance. The Planning Commission's meetings are open to the public and are advertised according to the Pennsylvania Sunshine Act (65 PA C.S.A.). All 52 municipalities are covered by the County Comprehensive Plan.

Technical assistance on community planning matters is provided to the Lycoming County Planning Commission and the County Board of Commissioners through the Lycoming County Planning and Community Development Department. The Planning and Community Development Department administers the County Comprehensive Plan, along with the County Subdivision and Land Development Ordinance. The Planning and Community Development Department also performs technical reviews of municipal subdivision and land development plans, municipal floodplain ordinances, municipal stormwater management plans and ordinances, and other community planning and development matters. Since the adoption of the existing HMP, these reviews have included informal cross-referencing of the planned development or regulatory activity with the provisions of the HMP. This practice will continue using the information in the updated HMP.

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.

Lycoming County's current Comprehensive Plan was adopted on August 24, 2006. This plan provides general direction and a blueprint for the future of Lycoming County and constituent communities. Recommendations from the HMP can be incorporated into the document and as reflected in Section 4.4.4, several hazard mitigation techniques are already reflected in the Comprehensive Plan. Additional hazard mitigation strategies that have been incorporated into the Comprehensive Plan include:

- Strategic Action 1l.: “Revise local and County ordinances to prohibit new floodplain development and to regulate expansion of existing floodplain development.”

- Strategic Action 1m.: “Revise property maintenance codes to include flood proofing and flood mitigation for existing properties in the floodplain.”

- Strategic Action 1n.: “Review and revise local and County zoning ordinances to permit additional private and public recreation uses.”

- Strategic Action 3c.: “Provide information on the use of growth areas for sound land use planning and community development.

- Strategic Action 3d.: “Provide information on the impacts of building and expanding development in the floodplain.”

- Strategic Action 7c.: “Identify and map riparian forest buffers, wetlands & natural undeveloped water retention areas and encourage stream bank preservation programs.”

- Strategic Action 7d.: “Encourage restoration of natural floodplain functioning, and use of acquisition and restoration or demolition programs.”

- Strategic Action 7e.: “Develop a countywide strategy for open space preservation. Inventory and assess open space. Prioritize protection efforts.”

- Strategic Action 7f.: “Assist in locating funding streams for resource preservation. Coordinate preservation funding with public and private partners.”

- Strategic Action 8c.: “Develop multi-modal transportation connections between residential neighborhoods and recreational areas.”

- Strategic Action 8g.: “Coordinate infrastructure improvements and expansion within growth areas. Discourage infrastructure investment in rural resource areas.

- Strategic Action 9a.: “Promote forest cover and forest stewardship to promote stormwater filtration (quality) and infiltration (recharge).”

- Strategic Action 9c.: “Revise ordinances to establish buffer zones around valuable wetlands.”

- Strategic Action 9d.: “Develop a Greenways Plan to complement open space, natural resource, and alternative transportation goals.”

- Strategic Action 9e.: "Promote land use patterns that reduce vehicle trips and encourage pedestrian, bicycle, and transit alternatives."

- Strategic Action 9f.: "Protect water supply and water quality."

Lycoming 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 Lycoming 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 52 local Emergency Management Coordinators (EMCs) for safekeeping.

The Lycoming 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.

Lycoming 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 Lycoming 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.

Like the HMP, stormwater management plans must be reviewed (and revised, if necessary) every five years. The stormwater management plan was adopted in May 2010. As both plans are maintained by the Lycoming County Planning and Community Development Department, information gathered in the revision of one plan will be incorporated into the revision of the other.

Old Mill Corridor Plan

The Old Mill Corridor Plan is one section of the Lycoming County Municipal Corridor Plans (the other section addressing the I-80 Corridor in Williamsport, Pennsylvania). This plan is "designed to provide a comprehensive understanding of the future use and redevelopment

potential of the Old Mill Corridor in Montgomery Borough. In creating this plan, both the Lycoming County Comprehensive Plan and the HMP were consulted. From these plans, the County determined that the Old Mill Corridor exists almost entirely in the 1%-chance floodplain, and as such is subject to Montgomery Borough's floodplain regulations. The Old Mill Corridor Plan lists several restrictions on development in the corridor based on those regulations, including elevation of the first floor 1.5 feet above the base flood elevation (BFE), prohibition of basements or crawl spaces below grade, and elevation of utilities above the BFE.

There is no required maintenance schedule for this plan. It will be reviewed and updated on an as-needed basis during its implementation. Any changes will be in consonance with the HMP and the Comprehensive Plan.

Chesapeake Bay Pollutant Reduction Plan (CBPRP)

As required by the Williamsport Area Joint MS4 NPDES Permit, the Lycoming County MS4 Coalition developed a CBPRP in April 2015. The open space created through the hazard mitigation buyout program was listed as a priority best management practice (BMP) for consideration as riparian buffer restoration and/or tree planting activities moving forward as part of the MS4 permit. Riparian buffer restoration is an effective method of reducing water volume and pollutant discharge to waterways. Buffers create habitat, promote infiltration, and reduce pollution runoff by providing a minimum distance between the water resource and development. At locations of open space restoration associated with the flood-prone property buyout program, riparian buffer restoration is recommended. These sites will be investigated to determine the feasibility of revegetating the properties with native trees and shrubs.

Plan Interrelationships

Figure 5.2.5-1 illustrates the interrelationships between the HMP, County Comprehensive Plan, County EOP, and other community planning mechanisms. Ensuring consistency between these planning mechanisms is critical. In fact, Section 301 (4.1) of the Pennsylvania Municipalities Planning Code requires that comprehensive plans include a discussion of the interrelationships among their various plan components, "which may include an estimate of the environmental, energy conservation, fiscal, economic development, and social consequences on the environment."

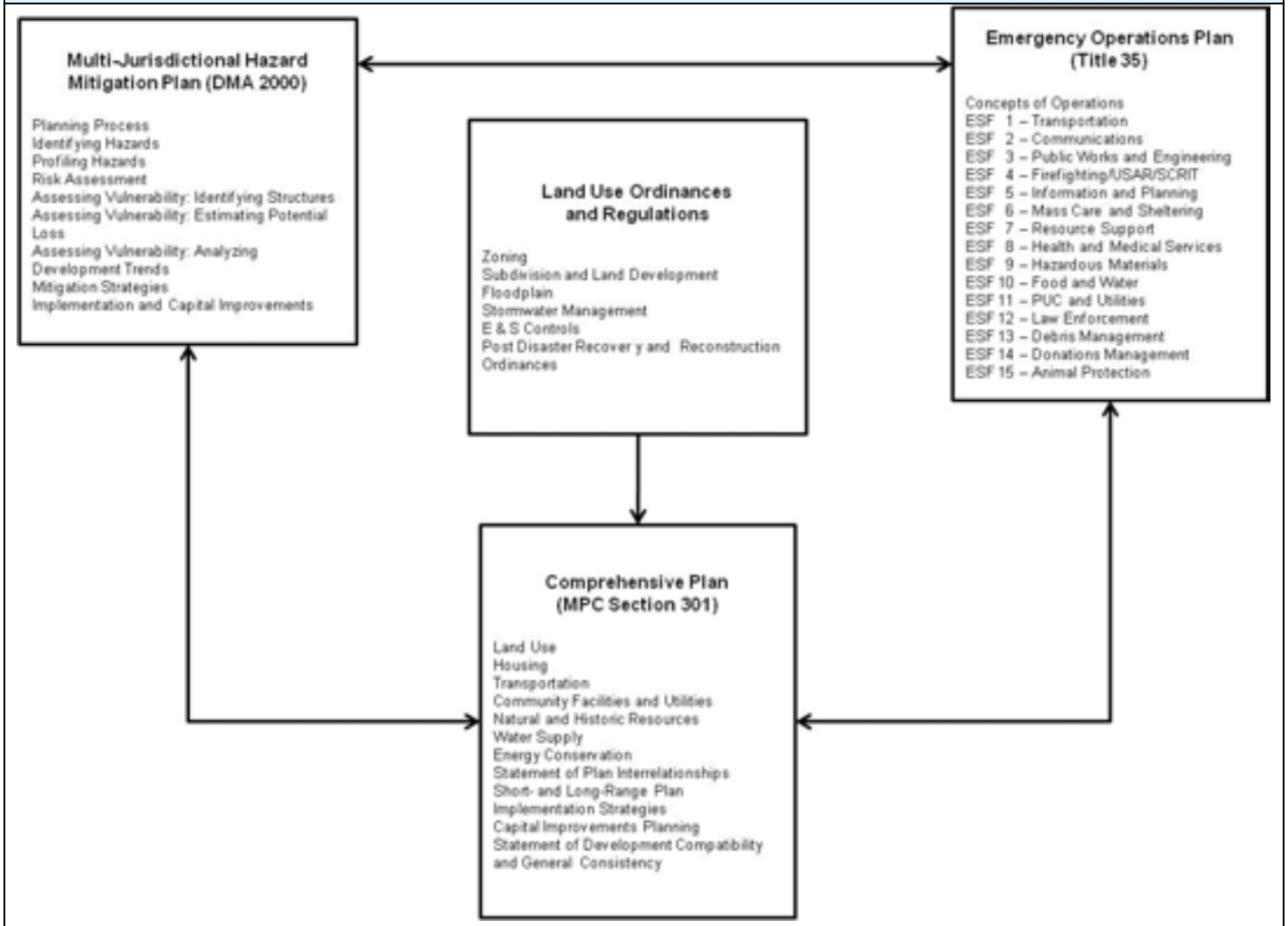
When developing the HMP, certain sections of the County Comprehensive Plan, EOP, and various land use ordinances and regulations provided key information. Moving forward, each of these documents should not be treated as unrelated and updated separately. The County and each participating municipality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

For example, zoning and other land use regulations will be amended to reflect the newly identified hazard areas, to ensure that development in those areas is minimized or at least conducted in a way that otherwise mitigates against the effects of hazards (e.g., requiring structures built in the floodplain to be elevated). As proposed changes to building codes are presented, their potential for mitigating damage due to hazards will be examined, and the

changes will only be adopted if they are shown to lower risk. Changes to stormwater management plans will incorporate identified mitigation actions and will encourage increased participation in the NFIP.

To that end, Lycoming 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. Lycoming 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.

Figure 5.2.5-1 **Lycoming County Planning Mechanism Interrelationships**



6. Mitigation Strategy

6.1. Update Process Summary

This section of the Lycoming County Hazard Mitigation Plan (HMP) identifies the goals, objectives, actions, and mitigation action plan for mitigating against the impacts of hazards.

Goals are general guidelines that explain what you want to achieve. Goals are usually expressed as broad policy statements representing desired long-term results.

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.

Actions provide more detailed descriptions of specific work tasks to help a community achieve the goals and objectives. For each objective statement, there are alternatives for mitigation actions that must be evaluated to determine the best choices for each situation (see Section 3: Alternative Mitigation Actions).

The **Mitigation Action Plan** includes a listing and description of the preferred mitigation actions and the strategy for implementation (e.g., who is responsible, how will they proceed, when should action be initiated and/or completed, etc.).

The goals and objectives listed in the HMP were first examined during the five-year plan review held as part of the Kick-off Meeting. During this review, the Steering Committee members were afforded the opportunity to comment on the goals, objectives, and actions that were listed in the existing HMP. In addition, throughout the course of the plan update, the HMP was posted on the County's Web site. All correspondence that was distributed to the municipalities referenced the Web site and welcomed comments on the HMP to the County Department of Public Safety or the Planning and Community Development Department (PCD), or to Delta.

In 2005, Lycoming County chose to align its mitigation goals with those listed in the State Hazard Mitigation Plan:

- To encourage actions that support public safety during hazard events, natural hazard identification and awareness, hazard avoidance, damage minimization, environmental historic protection, and the mitigation of future severe and repetitive damage due to natural hazards
- To ensure that local and state agencies identify critical buildings, facilities, and infrastructure that are at risk of damage due to natural hazards, and to undertake feasible and cost-effective hazard mitigation measures to minimize future losses and expenditures
- To make hazard mitigation a public value
- To promote economic development consistent with floodplain management, building codes, and similar guidance

- To develop an effective public awareness program for the natural hazards that Pennsylvania is most likely to experience
- To encourage scientific study of natural hazards and the development of data to support mitigation strategies for those hazards that are a threat to the Commonwealth
- To promote recognition of the value of hazard mitigation to the health, safety, and welfare of the population

On November 17, 2009, the Steering Committee hosted a Mitigation Solutions Workshop, which was attended by several County, municipal, and private industry representatives. The purpose of this workshop was to provide another opportunity to review the current goals, objectives, and actions listed in the HMP, and to determine what the revised HMP's goals, objectives, and actions would be. The goals, objectives, and mitigation techniques to be considered in the document were identified. The Steering Committee then used the outcomes from the workshop to identify and prioritize the final mitigation actions that would be included in the HMP.

The Steering Committee determined that each of the goals and objectives listed in the 2005 version of the HMP will be continued (i.e., deferred) in the current version of the plan although wording was revised. During the 2015 HMP Update process the Steering Committee once again determined that the list of goals and objectives would be continued. No additional changes were made.

6.2. Mitigation Goals and Objectives

Mitigation Goals and Objectives were reviewed and updated in 2010. These objectives addressed in more specific terms the results of the vulnerability assessment and reflected the nature of what can be mitigated for the identified hazards, as well as existing limitations in data and information. These goals and objectives were reviewed by the Steering Committee during the 2015 HMP Update and no changes were made. A Stormwater Management Plan, noted in Objective 1.B, was developed by the County and adopted by all 52 municipalities. It will continue to be updated as needed.

Goal 1: Prevent hazards from impacting the community.

Objective 1.A:	*Work with the municipalities to create and/or update land use regulations (e.g., zoning, subdivision, and land development).*
Objective 1.B:	*Complete and/or update stormwater management plans for all the watersheds in the County.*
Objective 1.C:	*Promote municipal participation in the NFIP and CRS.*
Objective 1.D:	*Evaluate hazard impacts and potential preventive measures.*
Objective 1.E:	*Maintain permit tracking.*

Goal 2: Protect the people, property, and environment in hazard areas.

Objective 2.A:	*Acquire properties within hazard areas.*

Objective 2.B: *Retrofit structures to withstand hazard impacts.*

Objective 2.C: *Relocate structures to outside of hazard areas.*

Objective 2.D: *Ensure future public facilities can withstand hazard impacts.*

Goal 3: Maintain and enhance emergency services capabilities in the community.

Objective 3.A: *Conduct and enhance emergency planning activities.*

Objective 3.B: *Improve alert and warning systems.*

Goal 4: Protect natural resources within the hazard areas.

Objective 4.A: *Protect natural functions of waterways.*

Objective 4.B: *Protect watersheds in the County.*

Goal 5: Ensure that stakeholder groups have the necessary information to mitigate against hazard impacts.

Objective 5.A: *Promote personal mitigation measures to the general public.*

Objective 5.B: *Promote public awareness of previous hazard impacts.*

Objective 5.C: *Conduct community outreach regarding hazard mitigation.*

Goal 6: Implement structural projects to reduce the impacts of hazards.

Objective 6.A: *Maintain infrastructure.*

Objective 6.B: *Design and implement flood control projects.*

6.3. Identification & 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 October 2013 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 also 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.

To identify possible mitigation actions a mitigation technique matrix was developed. Refer to Table 6.3-1. The matrix identifies mitigation techniques for each high and moderate risk hazards identified in the risk assessment. The matrix is used to help identify specific mitigation actions to be included in the mitigation action plan. Mitigation Techniques were reviewed during the Hazard Mitigation Workshop and at the Public Meeting.

Table 6.3-1 Mitigation Techniques Matrix

HAZARD	MITIGATION TECHNIQUES			
	LOCAL PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE PROJECTS	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS PROGRAMS
Flood, Flash Flood, Ice Jam	X	X		X
Winter Storm	X	X		X
Utility Interruption	X	X		X
Drought				X
Transportation Accident	X	X		X
Nuclear Incident				X
Wildfire	X		X	X
Environmental Hazard	X			X
Tornado, Windstorm	X	X		X
Earthquake	X	X		X
Hailstorm	X	X		X
Disorientation	X	X		X
Terrorism	X			X
Subsidence, Sinkhole	X			X

6.4. Mitigation Action Plan

As part of the mitigation strategy review, stakeholders were provided a mitigation strategy review worksheet and asked to provide information on mitigation activities that may have occurred over the last five years. The 2010 Mitigation Action Plan contained a list of general activities without assigned leads or potential funding sources shown below in Table 6.4-1. During the evaluation, which is detailed in Table 6.4-1, the majority of the activities were determined to be less specific than actions and often duplicated or covered by the existing goals and objectives. The new Mitigation Action Plan provided in Table 6.4-2, was developed by the Lycoming County HM Steering Committee which was informed by the Risk Assessment and information obtained from stakeholders. Appendix H provides a list of Hazard Mitigation Project Grant Opportunity (HMPGO) Forms completed through the county's website at http://www.lyco.org/Departments/PlanningandCommunityDevelopment/HazardMitigation/HazardMitigationRequestForm.aspx. Hard copies of previously submitted HMPGO's are available at the Lycoming County Department of Planning and Community Development.

Table 6.4-1 Mitigation Action Evaluation

MITIGATION ACTION	EVALUATION
High-Priority Actions	
1.A.2: Incorporate hazard mitigation objectives into Comprehensive Plan and CIPs.	To be completed in 2016 during Comprehensive Plan Update. The existing Comprehensive Plan contains seven strategic actions that were identified as mitigation initiatives that steer future development out of high hazard areas or reduce impacts from flooding (see Section 4.4.4).
1.A.6: Improve floodplain management practices.	The County revised its FPMO in March 2014 with multiple requirements including freeboard and prohibition of hazardous materials. Nineteen municipalities adopted this zoning ordinance with more stringent FPM requirements. The County is currently drafting suggestive language for the next FMPO update which is scheduled for late 2016 when the new maps become effective.
1.B.1: Create and maintain stormwater management plans for the County's watersheds.	Completed and covered under Objective 1.B. The Stormwater Management Plan was adopted by all municipalities in 2014.
2.A.1: Acquire floodway properties for greenway open space.	Completed multiple acquisitions since last HMP update. Some property has been converted to community gardens.
2.A.2: Acquire floodway land for Lower Lycoming project.	Acquisition projects combined under Action #22. Multiple properties acquired within the Lower Lycoming Watershed between Lewis Township and the Susquehanna River.

Table 6.4-1 Mitigation Action Evaluation	
MITIGATION ACTION	**EVALUATION**
2.B.1: Seek funding to retrofit flood-prone homes/businesses.	Covered under Objective 2.B. Pier 87 Bar and Grill was rebuilt and retrofitted in 2011 after being affected by flooding from Loyalsock Creek. It was elevated to 4+ feet above the BFE.
2.B.2: Seek funds to protect public sewer, water, and critical facilities.	Covered under Objectives 2.B and 6.B and incorporated into Action #10.
2.B.3: Protect or remove repetitive loss and floodway properties.	Acquisition projects combined under Action #22 and covered under Goal 2 Objectives.
2.B.4: Make vulnerable critical facilities, etc., disaster resistant.	Covered under Goal 2 Objectives and Action 10. Vulnerable critical facilities have been identified through this planning process and will be considered over the next 5 years for disaster resistant applications.
2.C.1: Assist in relocation of historically significant structures.	Covered under Objective 2.C. No historically significant structures have been identified for relocation however the online hazard mitigation project opportunity form tracks whether a structure is historical or not. To date no historical properties have been submitted through the online application system.
2.D.1: Build disaster-resistant public infrastructure.	Covered under Objectives 2.D. The water treatment plant in Nippenose Township was constructed at (or above) the BFE.
3.B.2: Encourage use of alert radios, RSS feeds, inundation mapping, the County FWS, and other Internet technologies by owners/operators of critical facilities.	Covered under Goal 5 Objectives. County will continue to provide stream gauge information through Flood Ready. They are looking for opportunities to tie gauge station data to flood intervals to improve warnings.
4.A.1: Promote natural functioning of floodplains, wetlands, etc.	Covered under Goal 4 Objectives. The Lycoming County Conservation District (LCCD) and Lycoming County Planning Commission, were part of a collaborative effort to produce a book titled “Living With Pennsylvania Streams”. The Lycoming Creek Watershed Association is also in the planning stages of the Trout Run Park Project.
4.A.2: Implement BMPs to protect natural functioning of floodplains.	Covered under Goal 4 Objectives. LCCD has implemented multiple stream and farm projects.
4.A.3: Seek funds for riparian buffers, E&S control, and stabilizing banks.	Covered under Goal 4 Objectives. Lewis Township Park was upgraded since the last HMP update.

Table 6.4-1 Mitigation Action Evaluation	
MITIGATION ACTION	**EVALUATION**
4.A.4: Assist in converting LLC FW land to greenway park.	This action is unknown, however, the County listed the open space that has been created from the acquisition and demolition of properties as open space restoration in their Williamsport Area Joint MS4s
4.B.1: Implement multi-objective watershed management approach.	RiskMAP and Flood Hazard Mitigation Planning have been conducted at the watershed level. Structures have
4.B.2: Co-sponsor and support watershed clean-up events.	Lewis Township held a watershed clean-up event.
5.C.3: Sponsor environmental education and watershed management workshops.	Covered under Objectives 4.B and 5.C. Lycoming Creek Watershed Association routinely hosts watershed related outreach events.
6.B.1: Secure funding partners to implement Lycoming Creek Project.	Action #22 encompasses acquisition projects. Several properties have been acquired as part of this project. The Lycoming Creek Watershed Association and the Conservation District are Lycoming Creek partners but no outside funding has been secured.
6.B.2: Implement five-component Heshbon-Hepburnville plan.	This project is unknown. There is no record of this plan and the action has been discontinued and removed from the HMP.
6.B.3: Design the concept for the Lower Lycoming Creek project.	This project is underway. Several properties have been acquired in the Lower Lycoming Watershed. Action #22 covers acquisition within the County.
6.B.4: Evaluate structural solutions for other at-risk "hot spots."	Covered under Goal 2 objectives. This intent of this action could not be determined but the county
6.B.5: Construct an earthen levee in order to protect Montoursville Borough from both flooding on the Susquehanna River and backwater flooding from Loyalsock Creek.	Project currently under review. In progress.
6.B.6: Eliminate the possibility of failure of public infrastructure and localized flooding due to undersized culvert section of Lawshee Run.	No progress to date. Culvert replacement has been discussed as an activity potentially funded through HMGP.
Medium-Priority Actions	
1.A.1: Adopt disaster-resistant, sustainable community strategy.	This will be accomplished through the Comprehensive Plan update and hazard mitigation planning.

Table 6.4-1 Mitigation Action Evaluation	
MITIGATION ACTION	**EVALUATION**
5.C.2: Promote building safe, sustainable community initiatives.	The existing Comprehensive Plan contains seven strategic actions that were identified as mitigation initiatives that steer future development out of high hazard areas or reduce impacts from flooding (see Section 4.4.4).
1.A.3: Adopt "official map" defining acquisition, retrofit, and relocation areas.	Completed acquisitions have been mapped as part of this HMP update and potential future mitigation opportunities have been tracked through the RiskMAP process.
6.A.1: Regularly clean and maintain drainage culverts.	Covered under Objective 6.A. This is completed at a municipal level. Urban municipalities that are part of the MS4 permit are required to regularly maintain stormwater inlets and outfalls as well.
6.A.2: Evaluate and upgrade transportation infrastructure to reduce damages.	Covered under Objective 6.A. Structurally deficient bridges were tracked and presented in the Long Range Transportation Plan. A related mitigation action was developed during this plan update. See Action 20.
1.A.5: Adopt flood damage reduction construction code.	All municipalities have floodplain management regulations or have adopted the County's Zoning/Subdivision Ordinance which contains floodplain management regulations.
5.A.2: Provide "how to retrofit" self-help literature to residents.	Resource Conservation and Development Council has implemented low impact development projects with partners such as Lycoming Water and Sewer and Muncy Heritage.
5.A.3: Educate public about "what to do" if floods occur.	Public awareness and education is ongoing. FloodReady site is ongoing. http://www.lyco.org/PublicSafety/FloodReady.aspx. Creating Lycoming Area Television (LCAT) videos explaining what to do in a flood. Covered under Objective 5.A.
5.C.1: Publish newsletter/brochure to improve emergency preparedness.	Covered under Objective 5.A. No newsletter was published however information is posted regularly to the county website.

Table 6.4-1 Mitigation Action Evaluation	
MITIGATION ACTION	**EVALUATION**
5.C.4: Provide hazard maps and promote Internet hazard mapping.	Flood Insurance Rate Maps are available to the public online through the County website. GIS data including SFHA, elevations, parcel numbers and soil type, among other things, can be viewed by address.
Low-Priority Actions	
1.C.1: Promote NFIP and CRS participation.	Covered under Objective 1.C. All municipalities participate in the NFIP. Jersey Shore Borough is currently working towards a higher CRS class (9 to 6).
1.C.2: Organize joint entity to manage flood protection.	Currently NFIP and flood related assistance is overseen on the County level by the Department of Planning and Community Development. A specific position was created, Hazard Reduction Specialist, to focus on the hazard mitigation grant program.
3.B.1: Improve flood warning to residents and business owners.	Covered under Objective 3.B. The County's Flood Ready website (http://www.lyco.org/PublicSafety/FloodReady.aspx) also provides real time stream gauge information using an interactive watershed map.
5.A.1: Educate public about NFIP, CRS, and FIRM (flood maps).	As part of RiskMAP, the County has performed outreach during the Discovery process and additional information about the preliminary flood maps, CRS and the NFIP was provided during the HMP process. Covered under Objective 1.C.
5.A.4: Encourage use of alert radios, Lycoming County FWS Web site, and other Internet technologies by homeowners.	The County routinely disseminates information about flood related resources available to the public during meetings, workshops, and various other events. Covered under Objective 5.C.
3.A.1: Coordinate evacuation plans with major employers.	Integrated Contingency Plan coordination occurred between LCPCD and Water and Sewer Authority
3.A.2: Improve emergency response procedures and capabilities.	Covered under Goal 3 Objectives. The EOP was revised in 2010 and gas well response plans are now in place.
3.A.3: Conduct detailed vulnerability assessment of critical facilities, etc.	An assessment of critical facilities was performed as part of this HM planning process and will be updated at a minimum, every five years.
1.E.1: Maintain property flood damage/loss/history permit tracking system.	Currently utilizing FEMA CIS for premium and insurance information.

Table 6.4-1 Mitigation Action Evaluation	
MITIGATION ACTION	**EVALUATION**
1.A.4: Adopt "no basement zone" in 0.2% chance floodplain and alluvial soils.	Not implemented during the last FP ordinance update. This may be suggested as part of the next FPMO update in 2016.
5.B.1: Place flood of record monuments around damage centers.	High water mark information is tracked.
1.D.1: Evaluate gravel deposition flooding and alternatives solutions.	Covered under Objective 4.A. No gravel deposition flooding alternatives were developed since the last plan update.

Table 6.4-2 lists the mitigation actions for the 2015 HMP update as developed by the Lycoming County HM Steering Committee. A total of 26 mitigation actions were selected for the 2015 HMP Update. Actions that will contribute toward continued compliance with and participation in the NFIP are noted and include 8, 18, 19, 21, and 22.

Table 6.4-2 Mitigation Action Plan	
COMMUNITY: Lycoming County **ACTION NO:** 1	**ACTION:** Initiate meeting with providers of electric power, land developers, and contractors to examine the cost and potential sources of funding for burying power lines.
Category:	Structure and Infrastructure Projects
Hazard(s) Addressed:	Utility Interruption; Tornado, Windstorm; Hailstorm, Winter Storm
Lead Agency/Department:	Lycoming County Planning & Community Development, Lycoming County Dept. of Public Safety
Implementation Schedule:	1-2 years
Funding Source:	Lycoming County Annual Budget
COMMUNITY: Lycoming County **ACTION NO:** 2	**ACTION:** Develop language for potential inclusion in subdivision regulations requiring new power and communications (telephone, cable television) lines to be buried.
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Utility Interruption; Tornado, Windstorm; Hailstorm, Winter Storm
Lead Agency/Department:	Lycoming County Planning & Community Development
Implementation Schedule:	3–5 years depending on outcome of meetings with developers and electric companies
Funding Source:	Borough, Township, & Lycoming County Annual Budgets
COMMUNITY: Lycoming County **ACTION NO:** 3	**ACTION:** Educate citizens and business owners about removing flammable vegetation or combustible materials from the immediate vicinity of buildings in wooded areas.
Category:	Education and Awareness Program
Hazard(s) Addressed:	Wildfire

Table 6.4-2 Mitigation Action Plan	
Lead Agency/Department:	Lycoming County Planning & Community Development, Chiefs of Municipal fire departments
Implementation Schedule:	1-2 years
Funding Source:	FEMA Fire Prevention and Safety Grant (FP&S)
COMMUNITY: Lycoming County **ACTION NO:** 4	**ACTION:** Provide workshops for farmers regarding livestock management and crop survival during times of drought, and/or water supply interruption.
Category:	Education and Awareness Programs
Hazard(s) Addressed:	Drought; Environmental Hazards
Lead Agency/Department:	Lycoming County Planning & Community Development, Lycoming County Conservation District
Implementation Schedule:	Annually
Funding Source:	USDA, Pennsylvania Dept. of Agriculture, Lycoming County Annual Budget
COMMUNITY: Lycoming County **ACTION NO:** 5	**ACTION:** Provide education for residents about water-saving landscaping techniques.
Category:	Education and Awareness Programs
Hazard(s) Addressed:	Drought
Lead Agency/Department:	Lycoming County Conservation District
Implementation Schedule:	Annually
Funding Source:	Lycoming County Annual Budget
COMMUNITY: Lycoming County **ACTION NO:** 6	**ACTION:** Provide information to schools, prisons, and nursing homes about the Great California Shake-Out and encourage participation in this educational program about surviving the immediate effects of an earthquake.
Category:	Education and Awareness Program
Hazard(s) Addressed:	Earthquake
Lead Agency/Department:	Lycoming County Dept. of Public Safety, Lycoming County Planning & Community Development
Implementation Schedule:	Annually
Funding Source:	PEMA
COMMUNITY: Lycoming County **ACTION NO:** 7	**ACTION:** Provide information to residents and business owners to examine the interior of structures to identify objects that may fall in the event of an earthquake (e.g., tall file cabinets, water heaters). Include information about anchoring.
Category:	Education and Awareness Program
Hazard(s) Addressed:	Earthquake

Table 6.4-2 Mitigation Action Plan	
Lead Agency/Department:	Lycoming County Dept. of Public Safety, Chiefs of Municipal fire departments
Implementation Schedule:	3 years.
Funding Source:	FEMA, Lycoming County
COMMUNITY: Lycoming County **ACTION NO:** 8	**ACTION:** After a flood event or windstorm provide information on alternatives to reconstruction of structures that sustain damages more than or equal to 50% of value to property owners.
Category:	Structure and Infrastructure Projects; NFIP
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam; Tornado, Windstorm; Wildfire; Winter Storm
Lead Agency/Department:	Lycoming County EMA, Lycoming County Planning & Community Development
Implementation Schedule:	5 years
Funding Source:	FEMA HMGP, Lycoming County
COMMUNITY: Lycoming County **ACTION NO:** 9	**ACTION:** Adopt Firewise Program.
Category:	Local Plans and Regulations; Natural Systems Protection
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	DCNR, Lycoming County Conservation District, Lycoming County Planning & Community Development
Implementation Schedule:	5 year rotation for hazard fuel mitigation projects; Annually for public education projects and training; Three years for updates on Emergency Action Plans
Funding Source:	U.S. Forest Service, DCNR
COMMUNITY: Lycoming County **ACTION NO:** 10	**ACTION:** Meet with Lycoming County Water and Sewer Authority (LCWSA) to review the LCWSA Integrated Contingency Plan to facilitate integration into hazard mitigation planning, emergency response, and other planning mechanisms in the County.
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Utility Interruption; Environmental Hazards
Lead Agency/Department:	Lycoming County Water and Sewer Authority; Lycoming County Planning and Community Development
Implementation Schedule:	6 months
Funding Source:	Staff Time
COMMUNITY: Limestone Township **ACTION NO:** 11	**ACTION:** Examine the possibility of amending/developing local zoning ordinances to direct new development away from areas underlain with carbonate bedrock
Category:	Local Plans and Regulations

Table 6.4-2 Mitigation Action Plan	
Hazard(s) Addressed:	Subsidence and Sinkhole
Lead Agency/Department:	Zoning Official for Township or Borough
Implementation Schedule:	3-5 years
Funding Source:	Borough, Township, and Lycoming County Annual Budgets
COMMUNITY: Plunkett's Creek Township **ACTION NO:** 12	**ACTION:** Install dry hydrants at water's edge along Loyalsock Creek.
Category:	Natural Systems Protection
Hazard(s) Addressed:	Wildfire
Lead Agency/Department:	Plunkett's Creek Township, Lycoming County Planning & Community Development
Implementation Schedule:	As funding becomes available
Funding Source:	FEMA/HMGP; PEMA; Municipality
COMMUNITY: Plunkett's Creek Township **ACTION NO:** 13	**ACTION:** Work with local carriers to expand and Improve cellular coverage.
Category:	Structure and Infrastructure Project
Hazard(s) Addressed:	Disorientation; All Hazards
Lead Agency/Department:	Plunkett's Creek Township; Lycoming County Department of Planning and Community Development
Implementation Schedule:	5 years
Funding Source:	EPMD; corporate
COMMUNITY: Picture Rocks Borough **ACTION NO:** 14	**ACTION:** Post relevant notices of future plans and proposed mitigation actions on municipal bulletin.
Category:	Education and Awareness
Hazard(s) Addressed:	All Hazards: Flood, Flash Flood, Ice Jam; Winter Storm; Utility Interruption; Drought; Transportation Accident; Nuclear Incident, Wildfire; Environmental Hazard; Tornado, Windstorm; Earthquake; Hailstorm; Disorientation; Terrorism; Subsidence, Sinkhole
Lead Agency/Department:	Borough
Implementation Schedule:	Annually
Funding Source:	Staff Time
COMMUNITY: Muncy Borough	**ACTION:** Conduct a housing stock survey of the community as

Table 6.4-2 Mitigation Action Plan	
ACTION NO: 15	part of "Project Resilience"
Category:	Local Plans and Regulations; Structure and Infrastructure Projects
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Winter Storm, Utility Interruption, Tornado, Windstorm, Earthquake
Lead Agency/Department:	Lycoming County Planning & Community Development, USACE, Muncy Borough
Implementation Schedule:	2 years
Funding Source:	PHARE Grant, USACE, Lycoming County, Muncy Borough
COMMUNITY: Wolf Township **ACTION NO:** 16	**ACTION:** Install/replace/repair culverts previously identified as problem areas Township-wide
Category:	Structure and Infrastructure Projects
Hazard(s) Addressed:	Flood, Flash Flood, & Ice Jam
Lead Agency/Department:	PennDOT, Lycoming County Planning & Community Development
Implementation Schedule:	As funds become available.
Funding Source:	PennDOT, FEMA, Lycoming County
COMMUNITY: Armstrong Township, Duboistown Borough, Fairfield Township, Limestone Township, Montoursville Borough, Muncy Creek Township, Muncy Township, Penn Township, Wolf Township **ACTION NO:** 17	**ACTION:** Disseminate pertinent information to municipal officials and residents as needed regarding local contingency planning for water and wastewater facilities once Lycoming County Water and Sewer Authority complete the Integrated Contingency Plan which includes information on more than 35 facilities.
Category:	Local Plans and Regulations; Education and Awareness
Hazard(s) Addressed:	Utility Interruption; Flood, Flash Flood, Ice Jam; Terrorism
Lead Agency/Department:	Lycoming County Water and Sewer Authority, Lycoming County Department of Planning and Community Development; Municalities
Implementation Schedule:	1 year
Funding Source:	Staff Time; General Fund
COMMUNITY: City of Williamsport, Loyalsock Township, Old Lycoming Township, Montoursville Borough, South Williamsport Borough **ACTION NO:** 18	**ACTION:** Obtain Levee accreditation (PAL) as part of RiskMAP.
Category:	Structure and Infrastructure Projects, NFIP
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Levee Failure

Table 6.4-2 Mitigation Action Plan	
Lead Agency/Department:	Municipalities
Implementation Schedule:	1 year
Funding Source:	General Fund
COMMUNITY: Hughesville Borough, Jersey Shore Borough, Montoursville Borough, Muncy Creek Township, City of Williamsport **ACTION NO:** 19	**ACTION:** Determine feasibility and/or BCA of online Project Opportunity Forms submitted by homeowners for buyout/elevation projects.
Category:	Structure and Infrastructure Projects, NFIP
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Lycoming County Department of Planning and Community Development; Municipalities as needed
Implementation Schedule:	1 year
Funding Source:	HMGP, General Fund
COMMUNITY: Armstrong Township, Eldred Township, Franklin Township, Gamble Township, Hepburn Township, Jordan Township, Lewis Township, Mill Creek Township, McIntyre Township, Moreland Township, Penn Township , Pine Township, Washington Township, Wolf Township, Woodward Township **ACTION NO:** 20	**ACTION:** Integrate deficient locally owned bridge (20 feet or longer) projects, identified in the Lycoming County WATS Long Range Transportation Plan, currently classified as *status inactive* and deemed essential for public use, into local planning.
Category:	Local Plans and Regulations; Structural and Infrastructure Projects
Hazard(s) Addressed:	Transportation Accident; Environmental Hazard
Lead Agency/Department:	Municipalities; Lycoming County (outreach)
Implementation Schedule:	3 years
Funding Source:	Staff time

COMMUNITY: Anthony Township, Armstrong Township, Bastress Township, Brady Township, Brown Township, Cascade Township, City of Williamsport, Clinton Township, Cogan House Township, Cummings Township, Duboistown Borough, Eldred Township, Fairfield Township, Franklin Township, Gamble Township, Hepburn Township, Hughesville Borough, Jackson Township, Jersey Shore Borough, Jordan Township, Lewis Township, Limestone Township, Loyalsock Township, Lycoming Township, Mchenry Township, Mcintyre Township, Mcnett Township, Mifflin Township, Mill Creek Township, Montgomery Borough, Montoursville Borough, Moreland Township, Muncy Borough, Muncy Creek Township, Muncy Township, Nippenose Township, Old Lycoming Township, Penn Township, Piatt Township, Picture Rocks Borough, Pine Township, Plunketts Creek Township, Porter Township, Salladasburg Borough, Shrewsbury Township, South Williamsport Borough, Susquehanna Township, Upper Fairfield Township, Washington Township, Watson Township, Wolf Township, and Woodward Township, Lycoming County **ACTION NO:** 21	**ACTION:** Update/revise, and adopt floodplain management ordinance as part of NFIP compliance and RiskMAP.
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Lycoming County, Municipalities
Implementation Schedule:	Before December 2015
Funding Source:	Staff time
COMMUNITY: Anthony Township, Armstrong Township, Bastress Township, Brady Township, Brown Township, Cascade Township, City of Williamsport, Clinton Township, Cogan House Township, Cummings Township, Duboistown	**ACTION:** Identify, acquire, and demolish, or retrofit structures with the highest relative vulnerabilities.

Table 6.4-2 Mitigation Action Plan	
Borough, Eldred Township, Fairfield Township, Franklin Township, Gamble Township, Hepburn Township, Hughesville Borough, Jackson Township, Jersey Shore Borough, Jordan Township, Lewis Township, Limestone Township, Loyalsock Township, Lycoming Township, Mchenry Township, Mcintyre Township, Mcnett Township, Mifflin Township, Mill Creek Township, Montgomery Borough, Montoursville Borough, Moreland Township, Muncy Borough, Muncy Creek Township, Muncy Township, Nippenose Township, Old Lycoming Township, Penn Township, Piatt Township, Picture Rocks Borough, Pine Township, Plunketts Creek Township, Porter Township, Salladasburg Borough, Shrewsbury Township, South Williamsport Borough, Susquehanna Township, Upper Fairfield Township, Washington Township, Watson Township, Wolf Township, and Woodward Township	
ACTION NO: 22	
Category:	Structure and Infrastructure (NFIP)
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Lycoming County Planning and Community Development, municipalities
Implementation Schedule:	Multi-year, ongoing
Funding Source:	HMGP
COMMUNITY: Lycoming County	**ACTION:** Obtain inundation information for areas near dams from the Pennsylvania Department of Environmental Protection, as it becomes available.
ACTION NO: 23	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Dam Failure
Lead Agency/Department:	Lycoming County Planning and Community Development, municipalities
Implementation Schedule:	Multi-year, ongoing
Funding Source:	HMGP

Table 6.4-2 Mitigation Action Plan	
COMMUNITY: Lycoming County	**ACTION:** Encourage homeowners to install appropriate devices to monitor and reduce radon exposure in homes.
ACTION NO: 24	
Category:	Education and Outreach
Hazard(s) Addressed:	Radon Exposure
Lead Agency/Department:	Lycoming County Planning and Community Development, municipalities
Implementation Schedule:	Multi-year, ongoing
Funding Source:	HMGP, PDM, CDBG-DR
COMMUNITY: City of Williamsport	**ACTION:** Furnish and install a permanent log picker with electrical distribution system at the Grafius Run Trash Rack at Highland Terrace similar to the one located at Freedom Road and Market Street.
ACTION NO: 25	
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	The City of Williamsport
Implementation Schedule:	1-year
Funding Source:	HMGP
COMMUNITY: Lycoming County	**ACTION:** Transfer information submitted on hard copies hazard mitigation project opportunity forms to the hazard mitigation project opportunity spreadsheet.
ACTION NO: 25	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Lycoming County Planning and Community Development
Implementation Schedule:	1-year
Funding Source:	Staff Time
COMMUNITY: Lycoming County	**ACTION:** Obtain additional structure/property data from tax assessor and complete an enhanced HAZUS analysis and incorporate vulnerability information into the HMP.
ACTION NO: 26	

Table 6.4-2 Mitigation Action Plan	
Category:	Local Plans and Regulations
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Lycoming County Planning and Community Development
Implementation Schedule:	1-year
Funding Source:	PDM

Actions were then compared with one another to determine a ranking or priority by applying the Multi-Objective Mitigation Action Prioritization criteria. Using the following weighted, multi-objective mitigation action prioritization criteria each action was evaluated:

- **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. Actions were prioritized using the cumulative score assigned to each. Each mitigation action was 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

Cumulative results of the HMPSC's prioritization of mitigation actions are listed by priority in Table 6.4-3.

Table 6.4-3 Prioritization of Mitigation Action Results

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					PRIORITY
ACTION NO.	NAME	EFFECTIVENESS	EFFICIENCY	MULTI-HAZARD MITIGATION	ADDRESSES HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIONS/ INFRASTRUCTURE	
10	Meet with Lycoming County Water and Sewer Authority (LCWSA) to review the LCWSA Integrated Contingency Plan to facilitate integration into hazard mitigation planning, emergency response, and other planning mechanisms in the County.	2	2	3	3	3	2.5
17	Disseminate pertinent information to municipal officials and residents as needed regarding local contingency planning for water and wastewater facilities once Lycoming County Water and Sewer Authority complete the Integrated Contingency Plan which includes information on more than 35 facilities.	2	2	3	3	3	2.5
2	Develop language for potential inclusion in subdivision regulations requiring new power and communications (telephone, cable television) lines to be buried.	2.5	1.5	3	3	3	2.5
18	Obtain Levee accreditation (PAL) as part of RiskMAP.	3	2.5	1	3	3	2.5
22	Identify, acquire, and demolish, or retrofit structures with the highest relative vulnerabilities.	3	3	1	3	2	2.5
23	Obtain inundation information for areas near dams from the Pennsylvania Department of Environmental Protection, as it becomes available.	2	2	3	3	3	2.5
1	Initiate meeting with providers of electric power, land developers, and contractors to examine the cost and potential sources of funding for burying power lines.	2	1.5	3	3	3	2.4
13	Work with local carriers to expand and Improve cellular coverage.	2	1.5	3	3	3	2.4

Table 6.4-3 Prioritization of Mitigation Action Results

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					PRIORITY
ACTION NO.	NAME	EFFECTIVENESS	EFFICIENCY	MULTI-HAZARD MITIGATION	ADDRESSES HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIONS/ INFRASTRUCTURE	
25	Furnish and install a permanent log picker with electrical distribution system at the Grafius Run Trash Rack at Highland Terrace similar to the one located at Freedom Road and Market Street.	2	3	1	3	3	2.4
26	Obtain additional structure/property data from tax assessor and complete an enhanced HAZUS analysis and incorporate vulnerability information into the HMP.	2	2	2	3	3	2.3
16	Install/replace/repair culverts previously identified as problem areas Township-wide	2.5	2	2	3	1.5	2.2
8	After a flood event or windstorm provide information on alternatives to reconstruction of structures that sustain damages more than or equal to 50% of value to property owners.	2.5	2.5	1	3	1	2.1
21	Update/revise, and adopt floodplain management ordinance as part of NFIP compliance and RiskMAP.	2.5	2	1	3	2	2.1
15	Conduct a housing stock survey of the community as part of “Project Resilience”	2	2	1	3	2.5	2
20	Integrate deficient locally owned bridge (20 feet or longer) projects, identified in the Lycoming County WATS Long Range Transportation Plan, currently classified as status inactive and deemed essential for public use, into local planning.	2.5	1.5	2	1	3	2
3	Educate citizens and business owners about removing flammable vegetation or combustible materials from the immediate vicinity of buildings in wooded areas.	2	3	1	1	2	2
19	Determine feasibility and/or BCA for online Project Opportunity Forms submitted by homeowners for buyout/elevation projects.	2.5	2	1	3	1	1.9

Table 6.4-3 Prioritization of Mitigation Action Results

MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					PRIORITY
ACTION NO.	NAME	EFFECTIVENESS	EFFICIENCY	MULTI-HAZARD MITIGATION	ADDRESSES HIGH RISK HAZARD	ADDRESSES CRITICAL COMMUNICATIONS/ INFRASTRUCTURE	
4	Provide workshops for farmers regarding livestock management and crop survival during times of drought, and/or water supply interruption.	1.5	2	2.5	2	1	1.9
5	Provide education for residents about water-saving landscaping techniques.	1.5	2	2	2	1.5	1.8
14	Post relevant notices of future plans and proposed mitigation actions on municipal bulletin	1.5	1.5	3	2	1	1.8
7	Provide information to residents and business owners to examine the interior of structures to identify objects that may fall in the event of an earthquake (e.g., tall file cabinets, water heaters). Include information about anchoring.	2	2	1	1	1	1.5
12	Install dry hydrants at water's edge along Loyalsock Creek.	2	2	1	1	1	1.5
11	Examine the possibility of amending/developing local zoning ordinances to direct new development away from areas underlain with carbonate bedrock.	3	1	1	1	1	1.4
6	Provide information to schools, prisons, and nursing homes about the Great California Shake-Out and encourage participation in this educational program about surviving the immediate effects of an earthquake.	1.5	1.5	1	1	1	1.3
9	Adopt Firewise Program.	1.5	1.5	1	1	1	1.3
24	Encourage homeowners to install appropriate devices to monitor and reduce radon exposure in homes.	1.5	1.5	1	1	1	1.3

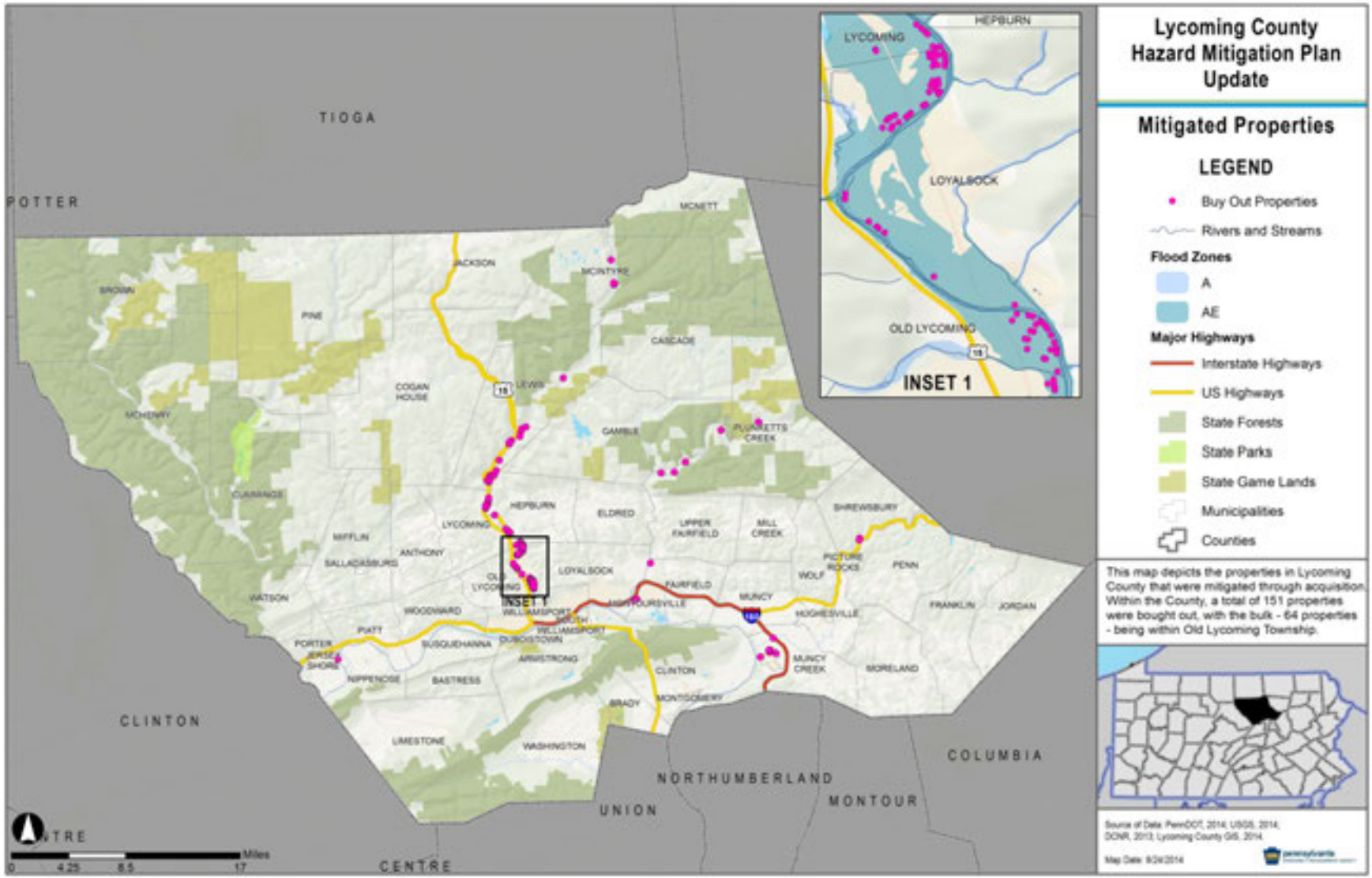
6.5. Mitigation Success

Since the County began its mitigation efforts, 214 properties in flood hazard areas have been acquired and returned to open space, and are being used as community parks, gardens, and greenways. Table 6.5-1 lists the number of acquired properties by municipality since the program began and Figure 6.4-1 shows the locations of each acquisition. Over the last five years approximately 108 properties have been acquired and demolished. Old Lycoming Township has the most mitigated properties at 78. The majority of properties are located along Lycoming Creek. Appendix I includes maps of the mitigated properties listed below.

Table 6.5-1 Number of Acquired Properties in Lycoming County by municipality.

MUNICIPALITY	NUMBER OF PROPERTIES
Hepburn Township	25
Jersey Shore Borough	1
Lewis Township	18
Loyalsock Township	8
Lycoming Township	17
McIntyre Township	4
Montgomery Borough	1
Montoursville Borough	3
Muncy Borough	45
Muncy Creek Township	4
Old Lycoming Township	78
Plunketts Creek Township	6
Shrewsbury Township	2
Woodward Township	2
TOTAL	**214**

Figure 6.5-2 Mitigated Property Locations.



Flood Summits

Since 2006, members of Lycoming County's planning staff and the Conservation District have teamed with Endless Mountains Resource Conservation & Development to organize and educate municipal officials in Bradford, Sullivan, Lycoming, Tioga, Susquehanna, and Wyoming Counties on a semi-annual basis. The 2007 summit touched on topics such as the history of development and stream dynamics, a discussion on watershed preservation, and floodplain management. In 2009, it concentrated on the topics of floodplain mapping, permitting, hazard mitigation, stormwater management, floodplain permitting, and included a field exercise. Future summits will focus on grants, emergency operations (e.g., damage reporting), and floodplain management as it pertains to the burgeoning natural gas industry in the region.

Flood Warning System

One of the most significant projects that the County of Lycoming has achieved is the completion of the Flood Warning System (FWS). The need for the advanced warning that this system provides was most salient during the January 1996 flood. During this flood event, citizens throughout the County endured millions of dollars of property damage, hundreds of flood-related injuries, and tragically, six deaths.

At a cost of $700,000, the FWS consists of 20 gauges (a combination of ultrasonic and pressure transducer units) on the County's five biggest tributary creeks (Pine Creek, Larry's Creek, Lycoming Creek, Loyalsock Creek, and Muncy Creek). It enables emergency responders to be alerted instantaneously to changes in stream height and initiates pre-flood operations such as warning businesses and residents about the imminent threat of flooding. The information provided by the FWS is also provided to the public via the Flood Ready link on the County's homepage (www.lyco.org).

Flood Mitigation Video

The Lycoming County Department of Public Safety produced a flood mitigation video in 2014 for Lycoming County Area Television (LCAT) that details RiskMAP, structural flood mitigation opportunities, and successful mitigation within the County.

Internet-Based Flood Map Viewing

The County of Lycoming has developed a Web portal that displays most of the County's GIS data layers to the public over the Internet. The available data layers include aerial photography, streets, zoning, topography, limited tax parcel information, and the County's current DFIRMS. The Web portal is located on the County's homepage and is provided free of charge to the general public.

Specifically pertaining to hazard mitigation, this portal enables realtors, lending institutions, current property owners, perspective buyers, and permitting officials to easily educate themselves on the flood status of a certain property. The portal has been utilized in the County's RISK map initiative as a public outreach tool. It provides municipal officials, and citizens, a means of reviewing the current DFIRMS against the proposed revisions to ensure that the final adopted product is as accurate as possible.

Lycoming County also partners with 30 of its 52 municipalities in providing a GIS-based permitting and municipal management system. This system, GeoPlan, makes all of the current GIS data that the County possesses, including effective DFIRMS, available to municipal officials. GeoPlan enables local permitting officials to utilize the best available mapping information during the permit evaluation process and also provides them an accurate way to track their issued permits. In addition, the County provides, free of charge, a GIS DVD of the County to emergency management and fire company personnel for use during emergency situations.

Jersey Shore Borough Inundation Mapping

Through a partnership with USGS and SRBC, the County enabled the National Weather Service to display a real-time inundation map of Jersey Shore Borough on their Advanced Hydrologic Prediction Service (AHPS) Web site. The inundation map shows the current and predicted levels of flooding by utilizing weather prediction software and current river-level readings from the Route 44 bridge gauge over the Susquehanna River. This capability was made publicly available on the AHPS Web site (http://water.weather.gov/ahps) in 2011.

Pier 87 Retrofit

Pier 87 Bar and Grill was destroyed by the flooding from Loyalsock Creek in 2011. The restaurant, that had been in the community for nearly 100 years, was rebuilt and elevated to more than 4 feet above the BFE, as seen in Figure 6.5-3.

Figure 6.5-3 Pier 87 Bar and Grill before and after mitigation.

Provision of Technical Assistance to Local Communities

The Lycoming County Planning and Community Development Department has three Certified Floodplain Managers on staff, including the Hazard Reduction Planner. These staff members are available to provide advice and mapping support to municipal zoning officers and officials with regard to proposed development within the special flood hazard area. The department also offers guidance to property owners regarding flood insurance and floodplain mapping.

Replacement of the Eck's Run Sluice Gate

The Borough of South Williamsport's levee system runs from Maynard Street in the west to almost the northernmost boundary of the borough, and is 12,180 feet in length. The levee protects approximately 774 properties. The U.S. Army Corps of Engineers' 2009 annual inspection report on the system noted that the Eck's Run Sluice Gate, which aids in the control and facilitated evacuation of stormwater runoff through the Eck's Run Pump Station, required immediate attention. In 2009, the County secured PA DEP funding to replace the gate.

Trout Run Village Floodplain Map Revision

The County Planning Department contracted with USGS to review and revise the existing floodplain mapping for the Village of Trout Run, in an effort to produce a flood insurance rate map (FIRM) that more accurately represents the Village's special flood hazard area. In 2009, USGS submitted the product of their study to the County Planning Department and Lewis Township for review and comment. Both parties were pleased with the outcome of this project.

7. Plan Maintenance

7.1. Update Process Summary

This update to Lycoming County's Federal Emergency Management Agency (FEMA)-approved Hazard Mitigation Plan (HMP) was a comprehensive update that expanded the sources and amount of data for better trend analysis, updated the vulnerability and risk assessment for local hazards, created a more fluid process to streamline future updates to the HMP, and updated the hazard mitigation measures identified to limit the effects of local hazards.

The original HMP states that it will be updated on a periodic basis, including in the aftermath of disasters or at least every five years. Since 2005, the HMP has actually been reviewed and evaluated more frequently, as it was consulted in the creation and/or update of other County planning documents (see Section 7.3). Any potential modifications to the HMP identified during the planning process for those other documents were noted by County planning staff and subsequently incorporated into the update of the HMP.

7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Lycoming County is the responsibility of all levels of government (i.e., county and local), as well as the citizens of the County. As listed in FEMA 386-4, the planning team (the Lycoming County Hazard Mitigation Steering Committee) must continuously

monitor and document the progress of the Plan's recommended actions. The Lycoming County Hazard Mitigation Steering Committee (listed in Section 3.2), under the direction of the Lycoming County Planning and Community Development Department, will be responsible for maintaining this Multi-Jurisdictional HMP. The Steering Committee will meet annually and following each emergency declaration, with the purpose of reviewing the Plan. Salvatore Vitko, Hazard Reduction Planner for the Lycoming County Planning and Community Development Department, will lead the Steering Committee for annual reviews of the HMP. Each year, the County will solicit new projects from the municipalities by sending out Project Opportunity Forms and informing the municipalities of the opportunity to update their mitigation measures.

Each review process will ensure that the Hazard Vulnerability Analysis and Risk Assessment reflect current conditions in the County and the municipalities, the Capability Assessment accurately reflects local circumstances, and the hazard mitigation strategies are updated based on the County's damage assessment reports and local mitigation project priorities. The Steering Committee will complete a Progress Report to evaluate the status and accuracy of the HMP and record the Steering Committee's findings. The Lycoming County Planning and Community Development Department will maintain a copy of these records.

As directed by FEMA 386-4, the Progress Report will include the following information: the hazard mitigation action's objectives; who the lead and supporting agencies responsible for implementation are; how long the project should take, including a delineation of the various stages of work along with timelines (milestones should be included); whether the resources needed for implementation, funding, staff time, and technical assistance are available, or if other arrangements must be made to obtain them; the types of permits or approvals necessary to implement the action; details on the ways the actions will be accomplished within the organization, and whether the duties will be assigned to agency staff or contracted out; and the current status of the project, identifying any issues that may hinder implementation.

The HMP must be updated on a five-year cycle. This HMP will be updated and resubmitted to FEMA for approval within the five-year period. The monitoring, evaluating, and updating of the Plan every five years will rely heavily on the outcomes of the annual Steering Committee meetings.

7.3. Continued Public Involvement

The Lycoming County Planning and Community Development Department will ensure that the HMP is posted and maintained on the County Web site, and will continue to encourage public review and comment on the plan through information posted to the Web site and public notices in the local newspaper.

The citizens of Lycoming County are encouraged to submit their comments to elected officials and/or members of the Hazard Mitigation Steering Committee. To promote public participation, Lycoming County welcomed comments on the HMP for a 30-day period. This offered the public the opportunity to share their comments and observations. All comments received will be maintained and considered by the Hazard Mitigation Steering Committee when updating the HMP.

The County also hosts the Flood Ready site on its County portal and the HMP project website will remain active through June 2015.

Lycoming County will continue to reach out to municipalities via telephone, mail, and e-mail regarding mitigation projects, especially those municipalities that did not submit projects for inclusion in this HMP. Any additional Hazard Mitigation Project Opportunity Forms received during the life of this five-year HMP will be incorporated into the Plan as an interim, updated and included in the next five-year Plan update.

8. Plan Adoption

The Plan was submitted to the Pennsylvania Emergency Management Agency on December 23, 2014. It was forwarded to FEMA for final review and approval-pending-adoption on XXXX, 2015. FEMA granted approval-pending-adoption on XXXX, 2015. Lycoming County adopted the plan on XXXX, 2015. Full approval from FEMA was received on XXXX, 2015.

This section of the plan includes copies of the local adoption resolutions passed by Lycoming County and its municipal governments; the completed Local Mitigation Plan Review Tool can be found in **Appendix B**. Adoption resolution templates are provided to assist the County and municipal governments with recommended language for future adoption of the HMP.

Lycoming County Hazard Mitigation Plan

County Adoption Resolution

Resolution No. _____

Lycoming County, Pennsylvania

WHEREAS, the municipalities of Lycoming County, Pennsylvania, are most vulnerable to natural and human-made 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, Lycoming County acknowledges the requirement 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 Lycoming County Hazard Mitigation Plan has been developed by the Lycoming County Planning and Community Development Department and the Lycoming County Emergency Management Agency, in cooperation with other County departments, local municipal officials, and the citizens of Lycoming County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Lycoming County Hazard Mitigation Plan, and

WHEREAS, the Lycoming County Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-made hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the County of Lycoming that:

- The Lycoming County 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 Lycoming County Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2010

ATTEST:

_____

LYCOMING COUNTY COMMISSIONERS

By _____

By _____

By _____

Lycoming County Hazard Mitigation Plan

Municipal Adoption Resolution

Resolution No. _____

<Borough/Township of Municipality Name>, Lycoming County, Pennsylvania

WHEREAS, the *<Borough/Township of Municipality Name>*, Lycoming County, Pennsylvania, is most vulnerable to natural and human-made 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 requirement 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 Lycoming County Hazard Mitigation Plan has been developed by the Lycoming County Planning and Community Development Department and the Lycoming County Emergency Management Agency in cooperation with other County departments, and officials and citizens of *<Borough/Township of Municipality Name>*, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Lycoming County Hazard Mitigation Plan, and

WHEREAS, the Lycoming County Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-made hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the *<Borough/Township of Municipality Name>*:

- The Lycoming County Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the *<Borough/Township>*, and
- The respective officials and agencies identified in the implementation strategy of the Lycoming County Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2010

ATTEST: ***<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>***

_____ By _____

By _____

By _____

9. Appendices

Appendix A –Bibliography
Appendix B –Local Mitigation Plan Review Tool
Appendix C –Meeting and Other Participation Documentation
Appendix D –Local Municipality Flood Vulnerability Maps
Appendix E –Critical Facilities
Appendix F –HAZUS Methodology and Results Reports
Appendix G –Dam Failure
Appendix H –Hazard Mitigation Project Opportunity
Appendix I –Completed Hazard Mitigation Projects