

Natural Hazard Mitigation Plan  
for the  
County of Athens, Ohio

Prepared by the Hazard Mitigation  
Planning Committee

County Commissioners:  
Mark Sullivan  
Lenny Eliason  
William “Bill” Theisen

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Members of the Natural Hazard Mitigation Planning Committee:

- Lenny Eliason, County Commissioner
- Russ Halbirt, Canaan Township Trustee and floodplain property owner
- Janet Antle, representing a business owner and floodplain property owner
- Charlotte Wachtel, Regional Planning Commission board member
- Doug Bentley, Athens County 911 Coordinator
- David Underwood, Red Cross
- Jill Harris, Director, Athens County Emergency Management Agency
- Steve Ferryman, Environmental Specialist, Division of Water, Ohio Department of Natural Resources
- Bob Eichenberg, Planning Director, Athens County Regional Planning Commission

Funding for this project came from a grant from the Ohio Department of Natural Resources Appalachian Flood Risk Reduction Initiative (AFRRI). The Ohio Department of Natural Resources (ODNR) received a grant from the United States Department of Commerce, Economic Development Administration, in order to make the AFRRI program possible. Each grant provided \$5,000 to assist with plan preparation and was matched with a \$5,000 local in-kind contribution. Additionally, the ODNR provided technical assistance to map approximately one mile of stream length in order to provide 100-year flood elevation and floodway boundary information. The value of ODNR's technical assistance for the stream mapping was estimated at \$10,000. A portion of the Hocking River downstream from the County Road 24A bridge was chosen for the additional map work.

# Chapter 1

## Introduction

### Section 1 – Natural Hazard Mitigation Planning

A Natural Hazard Mitigation Plan provides the means for a region's population to live safely protected from the extremes of nature's forces. While life is not risk-free, good planning can help minimize the dangers posed by nature's extremes. The Federal Emergency Management Agency (FEMA) defines hazard mitigation as "any action taken to reduce or eliminate the long-term risk to human life and property from hazards." For purposes of this plan, hazards are limited to those events, such as earthquakes, tornadoes, or floods, not primarily activated by human activity. While human activity may be what turns a natural event into a disaster, Mother Nature, rather than human activity, is what initiates the natural event.

Natural hazard mitigation planning involves participation in a process that accomplishes the following:

- Natural hazards analysis – Previous natural hazard events are studied to determine which natural hazards should be given priority status in the Plan.
- Asset identification – Structures and utilities that are vulnerable to natural hazard events are identified.
- Loss estimation – The amount of loss from a given scale hazard event (such as the 1% chance flood<sup>1</sup>) is calculated.
- Mitigation strategy – Goals and actions that reduce risk from hazard events are proposed.
- Gathers public input and provides information to the public – Citizen input is sought and information about the planning process is regularly provided.

The Disaster Mitigation Act of 2000 (DMA2K) requires that a natural hazard mitigation plan be developed before a community can be eligible for some forms of federal disaster relief funds. The Ohio Natural Hazard Mitigation Planning Handbook states, "The purpose of the plan is to ensure that the community has established goals and objectives, in addition to a well thought out process for mitigating future damages before approving projects." It also says that "a community or jurisdiction without a natural hazard mitigation plan will not be eligible for most sources of mitigation funding".

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<sup>1</sup> The 1% annual chance flood is the magnitude of flooding that has a statistical chance of occurring once every 100 years. This does not mean that a large magnitude flood won't happen more frequently than once in a great while. Because we are dealing with unpredictable weather patterns and statistical odds, it is possible to have several large floods within close proximity to one another. Also, a large flood that has a 1% chance of occurrence in any given year.

## Section 2 – Information About the County

Athens County is located in southeastern Ohio approximately 75 miles southeast of Columbus, the state capital. The County is comprised of 14 townships, 2 cities, and 8 villages contained in an area of approximately 484 square miles. The County's population in unincorporated areas is 29,519 and there are 10,725 housing units in this area according to the 2000 census. The population density of this rural area is 60.5 residents per square mile and the housing density is 22 units per square mile. For comparison, Ohio's population density is 277.3 residents per square mile and its housing density is 116.8 units per square mile. The same numbers for the City of Columbus are, respectively, 3,383.6 and 1,556.0. Additional County census data can be found in Appendix 1.

Athens County is located in a rural setting comprised of the rugged topography that makes up the unglaciated Allegheny Plateau region. The landscape is comprised of hills, narrow ridges, and narrow stream valleys. Underlying bedrock is composed of shales, siltstone, sandstone, limestone, and coal. The shales have weathered to produce many soils that are prone to instability. The narrow stream valleys have historically been chosen as settlements because they offer some of the flattest ground for building. Unfortunately, the same stream valleys are prone to flooding and have been the sites of flood disasters since people settled the area.

Elevations in the County range from a low of slightly less than 600 feet to a high of approximately 1060 feet. The Hocking River, with an overall watershed of 1,200 square miles, drains most of the County and travels through it for a distance of over 40 miles. The south central portion of the County is drained by the Shade River system. The Ohio River borders on the southeastern corner of the County for several miles.

Athens County is located in Ohio's Appalachian region. While much of Appalachia lags behind the state economically, Athens County is the home of Ohio University which provides the county's major employment opportunity. Athens County's unemployment figures are lower and per capita income is higher than most of the Appalachian Ohio region. In year 2000 the total employment for all industries in Athens County was 18,423 with government claiming the largest portion at 37.1%.

Major transportation arteries are U.S. Route 50 and State Routes 32, 56, and 550 travelling in an east-west direction and U.S. Route 33 and State Routes 13, 144, 329, and 681 travelling in a north-south direction. A Norfolk-Southern railroad line travelling between Charleston, West Virginia and Toledo, Ohio bisects the county in a north-south direction.

Appendix 2 shows the location of Athens County within the state of Ohio and Appendix 3 shows a base map of Athens County.

### Section 3 – The Planning Process

The planning process used by Athens County followed a combination of guidelines set forth by the Federal Emergency Management Agency, the Ohio Department of Natural Resources, the Ohio Emergency Management Agency, and the Athens County Regional Planning Commission. The planning process involved the following general steps:

- Organizing to plan
  - Members of the planning committee were chosen from the community and represented local government, the citizenry, neighborhood organizations, and Ohio University. The Athens County Regional Planning Commission agreed to provide technical assistance and write the plan. It was determined by the committee to hold monthly meetings.
  - A total of four public meetings were planned at various stages during plan writing to allow citizens an opportunity to participate in the process. Local media was also given information about the process and some coverage was provided. Appendix 4 contains a sample advertisement and newspaper articles. In addition to the formal public meetings all plan committee meetings were advertised and open to the public.
  - Letters were sent to agencies and organizations that have an interest in this plan and may wish to offer comment. A list of letter recipients is shown in Appendix 5. Representatives from the United States Geological Survey and the Ohio Department of Transportation also attended one of our meetings in order to gather and provide information. Meeting facilitation and technical assistance was provided by the ODNR Division of Water, Floodplain Management Program as part of the AFRRI grant.
  - A review of existing plans and legislation insured that this mitigation plan would be woven into the County’s planning process. The County has subdivision regulations and a floodplain management program. The County’s Emergency Management Agency is also actively working on an update to the County’s Emergency Operations Plan.
- Identify natural hazards that affect the County.
  - Previous natural hazard events were profiled to help determine levels of risk for each hazard.
  - Information from the profile in the previous step was quantified according to hazard probability and expected impact from the hazard. A high, medium, or low risk value was then assigned to each hazard.
- Vulnerability assessment
  - Asset identification – Residences, public buildings, critical facilities, and businesses were identified.
  - Potential loss estimation – Data from the County Auditor, utilities, and FEMA were utilized to calculate asset losses for hazards listed in the high risk categories.
  - Future land use as it relates to natural hazards was analyzed.

- The Plan
  - The current status and desired status of the County's hazard vulnerability were analyzed.
  - Problem statements, or reasons why the County was not achieving its desired status, were produced.
  - Goals, objectives, and activity steps were created.
  - Plan implementation and maintenance components of the Plan were developed.

## Chapter 2

### Natural Hazards that Affect the County

#### Section 1 – Natural Hazard Assessment

With only a few exceptions, the various natural hazards that might impact the County of Athens at some future time have likely been the same natural hazards that have historically impacted the County. Barring a major change in weather patterns, extreme weather events will likely occur in a similar fashion as the historic record indicates. There is a lively debate in scientific and policy-making communities about the causes and impacts of global warming. Because the variables are so many and the science about global warming still in its infancy, this Plan will not attempt to predict future weather patterns different from those of the past.

When a hazard assessment is performed, it is important to realize that unique and extreme environmental conditions are necessary to create extreme hazards. For instance, widespread flooding conditions are the result of strong low pressure weather systems that bring in large quantities of moist air. The flooding can be made worse if the rain occurs on already frozen ground during a rapid period of snow melt. Occasionally several strong weather systems will pass through an area within days of each other and if each brings large rainfall amounts, the flooding can be made much worse. On a similar note, while highly unlikely in southeastern Ohio, should an earthquake occur when our slip prone soils are already highly saturated we could be faced with landslides that are larger and more frequent than those to which we are accustomed.

Generally speaking, the more severe or extreme the natural event, the less likely its occurrence because of the unique circumstances required for that extreme event to happen. While any scale tornado in Athens County is rare, a truly large and destructive tornado has never happened and its chances of happening are extremely remote due to topography and weather patterns. While flooding in the County is not uncommon, large floods that cause significant damage are rare and the largest floods that can cause catastrophic damage are extremely rare. Because we are working with chance events however, large floods can occur in close sequence as happened to the Village of Amesville, in northeastern Athens County, when a record flood in 1997 was followed by a record flood in 1998 that measured six feet higher than the 1997 flood.

With the exception of earthquakes, natural hazards are associated with extreme events of weather. Even landslides require moisture and are more likely to occur after heavy rainfall events. Our climate has much to do with the type and severity of hazards that we face. An excellent book, Thunder in the Heartland, describes Ohio's climate and weather extremes as follows:

“...Ohio is in the middle latitudes, at low elevations, in the eastern interior of North America, and south of the Great Lakes. This location in the Heartland of North America gives Ohio a climate with four distinct seasons, large seasonal

temperature ranges, frequent precipitation, and the wide variety of weather so typical of the middle latitudes.

Severe and extreme weather of various sorts are also typical of the Heartland. Temperatures in Ohio have ranged from 113 degrees to nearly – 40 degrees. Frosts have blackened corn in July and shirtsleeves weather has prevailed at Christmas. Blizzards have isolated communities for days and flood waters have surged twenty feet deep through the main streets of Ohio’s cities....Drought has withered crops, hail the size of baseballs has punched through roofs of homes, and winds have blown lake freighters through bridges, trains off tracks, and homes onto sleeping occupants.”<sup>2</sup>

The first step of hazard identification is the production of a list of the natural hazards that could occur in the County. Between the expertise provided by members of the planning committee and historical research from a variety of sources, the following list of hazards for the County was compiled. The list<sup>3</sup> is alphabetical and not in any particular order of likelihood of occurrence or severity.

- Dam failure<sup>4</sup>
- Drought
- Earthquake
- Extreme heat
- Extreme cold
- Flooding (flash)
- Flooding (riverine)
- Hail
- High winds
- Ice Storms
- Landslide/Rockfall
- Land Subsidence
- Thunderstorms and lightning
- Tornado
- Winter storms/Blizzards
- Wildfire

## Section 2 – Natural Hazard Profiles

The second step with hazard identification is profiling the hazards. Profiling uses historic documentation and currently available information and technology to assess the comparative degree of risk between the various hazards. The spreadsheet in Appendix 6

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<sup>2</sup> Schmidlin, Thomas W. and Jeanne Appelhans Schmidlin, *Thunder in the Heartland*, The Kent State University Press, Kent, Ohio, 1996, p.1.

<sup>3</sup> Pestilence was considered but not included in the list.. Pestilence is a natural hazard but the Ohio Department of Health is so equipped to deal with such hazards that pestilence was not included in the scope of this plan. Also ruled out because environmental conditions make the hazard’s occurrence impossible are avalanche, coastal erosion, coastal storm, hurricane, tsunami, and volcano.

<sup>4</sup> Dam failure is included, even though it is an event caused by failure of a manmade structure, because such failure will most likely occur during or after a flood event.

shows historical information about previous natural hazards and helps to organize information so that the hazards that pose the greatest risk can be given the most attention in the Plan.

The table and chart in Appendix 7 show how the AFRRRI planning committee ranked the various natural hazards according to each hazard's relative risk. Risk was determined by multiplying a score for the probability of the hazard's occurrence by its possible impact. Probability and impact rating definitions are included.

ODNR, Division of Water, prepared a Multi-Hazard Map (Appendix 9) that accompanies this Plan. The Map displays areas subject to particular hazards showing specific geographic boundaries of floodplains, landslide susceptibility, and land subsidence. Also shown are the major dams in Athens County. The Map also includes an inventory of structures in the 1% annual chance floodplain and the location of streams, roads, and railroads. Copies of the files used to prepare this map can be obtained from the Athens County Regional Planning Commission.

An additional Athens County Hazard Zones Map (Appendix 9) was prepared by the Athens County Regional Planning Commission. The subsurface mine areas show the subsidence hazard locations and the floodplain is the 1% annual chance floodplain. These hazard areas correspond with the ODNR Multi-Hazard Map. The landslip areas on this map utilized soil types and degree of slope to obtain moderate and severe landslip potential locations.<sup>5</sup>

Each hazard identified by the Planning Committee will be described below. The hazard will be defined, explanations about historical events involving the particular hazard will be provided, and sources of information will be described, if necessary.

#### Subsection 2a – Dam Failure

There are several impounded water bodies in Athens County that could have an affect on downstream areas were one or several of the dams holding this water to fail. The large water bodies are Burr Oak Lake, Dow Lake, and the lakes that make up the Margaret Creek Conservancy District. The Margaret Creek Conservancy lakes are Meeks Lake, Lake Snowden, site number 4, site number 5, and Fox Lake. The Burr Oak dam is managed by the Corps of Engineers, the Dow Lake dam is managed by the Ohio Department of Natural Resources, Division of Water Dam Safety Section, and the Margaret Creek Conservancy District manages the remaining five lakes.

Burr Oak Lake, impounded by the Tom Jenkins Dam located in Athens County, and Lake Snowden in southwestern Athens County could have an affect on downstream areas should the dams fail. These dams are rated Class I. According to the ODNR, dams in Ohio have been divided into four classes; I, II, III, and IV based upon downstream threat potential. The failure of a class I dam will likely result in loss of life and pose a

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<sup>5</sup> The moderate and severe landslip classifications were derived from work done for the City of Athens Land Development Ordinance by Dr. Geoffrey Smith, OU Dept. of Geology.

serious hazard to health and property in the inundation area. A class I dam has a volume capacity over five thousand acre-feet or a height greater than sixty feet. Exempt from Ohio’s regulatory authority are dams less than six feet in height regardless of storage volume, dams less than 10 feet in height with not more than 50 acre-feet<sup>6</sup> of storage, or not more than 15 acre-feet of total storage regardless of height.

Dam failure is defined by the Army Corps of Engineers as “any condition resulting in the uncontrolled release of water other than over or through a spillway or outlet works.”<sup>7</sup> While dam failure is a highly unlikely event it is still possible and any natural hazard plan needs to consider it. The Flood Emergency Plan for Burr Oak Lake discusses inundation maps and states, “The attached maps indicate the area which would be flooded under the hypothesized conditions of: a) occurrence of a spillway design flood at Tom Jenkins Dam; and b) occurrence of a failure of the dam concurrent with a spillway design flood. The possibility is extremely remote that either condition will occur.” Failure of a dam will only occur during a major rainfall event when the impoundment has reached capacity and can no longer hold back the flow. Dams are designed with emergency spillways that allow for a controlled overtopping of the structure. In this way damage to the structure is non-existent or greatly reduced. However, should a dam fail, the damage below it can be far-reaching and severe.

During a heavy rainfall event in March 1997, water flowed over emergency spillways at Meeks Lake, site #4, and site #5. Subsequent to the 1997 floods, the dam at Lake Snowden was elevated to what is considered a “100% level”. According to Scott Jerome, a planning engineer with the Natural Resource Conservation Service, a dam at this level is capable of holding 24”-28” of rainfall in an eight hour period. This is more than the twice the amount of rainfall that has historically fallen in the Athens area.

Inundation maps were produced for the Margaret Creek Conservancy lakes and for Burr Oak Lake. The inundation map for Margaret Creek does not contain flood elevations but a comparison between it and the FEMA 1% chance flood map indicates that the inundation area affected is significantly larger than the 1% chance floodplain along some reaches of the Creek. The Burr Oak Flood Emergency Plan for the Tom Jenkins Dam calculated floodwater arrival times, peak flood times, and water elevations at various cross sections on the Hocking River from Nelsonville to Guysville in the events of a spillway design flood and dam failure. The spillway design flood is defined by the Corps of Engineers as “the maximum flow which a dam’s spillway is designed to pass safely.” At cross section #36, the location of the Convocation Center on Ohio University’s campus, the following data was provided:

	Spillway Design Flood	
	Without Dam Failure	With Dam Failure
Arrival Time	30 hrs. 00 mins.	11 hrs. 15 mins.
Peak Flood Time	45 hrs. 30 mins	24 hrs. 30 mins.
Peak Elevation	638.0 feet	647.0 feet

<sup>6</sup> One acre-foot is the amount of water that covers one acre to a depth of one foot or about 326,000 gallons.

<sup>7</sup> Burr Oak Inundation Plan and Map, U.S. Army Corps of Engineers

For comparison, the 1% chance flood at this cross section is 642 feet, so a dam failure on Burr Oak Lake when the spillway is already flowing at capacity could bring an additional five feet of water to the City 24 hrs. 30 mins. after the failure.

#### Subsection 2b – Drought

Drought is a normal, recurrent feature of climate. In general, a drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. This deficiency is often the result of a persistent high pressure that lowers humidity, precipitation and cloud cover and blocks moisture from entering the region. Droughts are slow, coming without warning over several weeks. They can effect vegetation, crops, and the water supply and can contribute to extreme heat events and wildfires.

Predicting drought is difficult because it relies on forecasting so many variables, primarily temperature and precipitation. Drought in Ohio has been recorded since 1895 using the Palmer Hydrological Drought Index (PHDI). Since then, six great Ohio droughts have occurred in 1895, 1930-31, 1934, 1953-54, 1963-64, and 1988.<sup>8</sup>  
<http://www.drought.unl.edu/index.htm>

#### Subsection 2c - Earthquake

Athens County has a relatively low susceptibility to severe and damaging earthquakes. Both a low PGA and only a single recorded earthquake occurring in 1886 characterize it. According to the United States Geological Survey, Athens County has Peak Ground Accelerations (PGA) ranging from approximately 2.53 %g to approximately 2.70 %g with a 10% chance of being exceeded over 50 years. The PGA is a measurement of the strength of ground movements and is used to determine the maximum severity of an earthquake. The PGA for Athens County means that the maximum severity of an earthquake will be relatively small (2.53 %g – 2.70 %g) with a 10 % chance of an earthquake exceeding this severity over 50 years. The USGS Peak Acceleration map in Appendix 8 also shows Athens County to have dark gray shading, coinciding with a PGA between 2 and 3%g with 10% chance of exceedance in 50 years.

Athens County's low PGA is consistent with the history of earthquakes in the county. Using the ESRI/FEMA Project Impact Hazard Site (<http://data.esri.com/hazards/makemap.html>), a Historic Earthquake Map for Athens County was produced. This map shows one earthquake occurring in Athens County prior to 1930 with a magnitude between 2 and 3.

*Geo Facts*, by the Ohio Department of Natural Resources, Division of Geological Survey identifies Southeast Ohio as “particularly susceptible to seismic activity.” Ten earthquakes have occurred in the area, with minor to moderate damage occurring in Scioto, Meigs, and Perry County. A map also identifies the previously mentioned Athens

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<sup>8</sup> Schmidlin, p. 147.

County earthquake as occurring in 1886. It shows the earthquake's intensity to be between IV and VI on the Modified Mercalli Scale. A level VI earthquake, the most extreme possible level of the 1886 earthquake is characterized as follows: "Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small."

#### Subsection 2d – Extreme Heat

According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region, last for prolonged periods of time, and are often accompanied by high humidity that the body cannot tolerate. Extreme heat in Ohio, with temperatures of 110 degrees or more can have a disastrous effect on the state.

A necessary condition for extreme heat in Ohio is a Midwest drought. Soils and vegetation are dry during these droughts, allowing the hot, dry air from the Southwest to enter Ohio without the cooling effects of evaporation. Ohio heat waves are most severe in Southern Ohio, while the Northeast is tempered by the cooler waters of Lake Erie.<sup>9</sup>

Extreme heat in Southeastern Ohio can have widespread effects on human health, energy use, vegetation and crops, and the behavior of materials. In addition to the high temperatures, the duration of a heat wave plays an important role in how people are affected. When extreme heat periods last more than two days, an increase in these effects occurs. Specific populations in Athens County that are at a high health risk during periods of extreme heat include the elderly, young children, isolated individuals, people without access to air-conditioning, and those with respiratory difficulties.

Southeast Ohio has a history of both high temperatures and prolonged heat waves. On August 6, 1918 Amesville recorded 110 degrees. Excluding a suspicious 113-degree reading in Gallia County, Amesville exceeded the previous highest Ohio temperature of 108 degrees in Pomeroy, Ohio.<sup>10</sup>

The summer of 1934 again brought extreme heat to Southeast Ohio. It was preceded by the driest May in history. It is estimated that 160 Ohioans died from heat during the 1934 summer heat wave. On July 21, 1934 Gallipolis recorded a temperature of 113 degrees, the hottest temperature ever recorded in Ohio. Southeast Ohio also experienced extreme heat periods in July of 1936, August of 1947, August of 1983, and June of 1988.<sup>11</sup>

FEMA provides information on Extreme Heat at <http://www.fema.gov/rrr/talkdiz/heat.shtm>. This site has tips on how individuals can plan for extreme heat, and what to do during a period of extreme heat.

#### Subsection 2e – Extreme Cold

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<sup>9</sup> Schmidlin, p. 129.

<sup>10</sup> Schmidlin, p. 131.

<sup>11</sup> Schmidlin, pp. 133-146.

The lowest temperatures in the wintertime come with arctic air masses from Canada. The coldest temperatures occur after a low pressure storm system has passed and left a fresh covering of snow. Arctic air follows as a high pressure system and centers itself in the Midwest. Clear skies will allow heat to radiate to space and the snow cover serves as an insulator between the warmer earth and the colder air.<sup>12</sup>

The state's coldest temperatures are not in the north, but in the valleys of southern and central Ohio. The hilly topography allows cold air to settle in valleys and some of these areas are far enough away from the temperature moderating effects of the Ohio River. The official record cold temperature for Ohio was  $-37^{\circ}$  set in 1912 near New Lexington in Perry County. January 19, 1994 was the greatest cold wave in Ohio when a greater part of the state registered  $-25^{\circ}$  or less than at any previous time on record. There were unofficial temperature readings of  $-40^{\circ}$  in Athens County.<sup>13</sup>

#### Subsection 2f - Flooding

The flood hazard is broken into two types of flooding, flash and riverine.<sup>14</sup> Before discussing the particulars of each type of flooding, some background information about flooding, in general, is warranted. Flooding is the phenomenon of drainageways (creeks, runs, streams, tributaries, branches, forks, and rivers) receiving more water runoff than they can contain within their banks. As water flows over the waterway's banks it occupies low lying areas, known as floodplains, adjacent to the waterway. The magnitude of floods is measured by their frequency interval or how often they occur, at that magnitude, on average. A large flood that only occurs, on average, once every 100-years is known as a 1% annual chance flood. A flood of this magnitude has a 1% chance of occurring in any given year.

It takes unique climatic circumstances to create large-scale flooding on major streams and rivers. Contributing factors can include already saturated soils, snowmelt, and intense rainfall. The intense rainfall comes from strong, low pressure weather systems that can occur in quick succession.

Larger waterways on more gently sloped land have larger watersheds and it takes longer for the flood to reach its peak level. This leads to what this Plan terms a slow riverine flood. Smaller watersheds in steeper terrain will drain faster and the streams will therefore rise more quickly and fall more quickly. Water velocity will also be greater on more steeply sloped terrain. The rapid rise of high velocity water leads to what is termed a flash flood. These floods can be dangerous because of the force of the rushing water and because there is little to no warning before they hit.

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<sup>12</sup> Schmidlin,

<sup>13</sup> Schmidlin,

<sup>14</sup> In its Hazard Analysis and Risk Assessment, the Ohio EMA breaks floods into four categories: riverine, flash, urban and small stream, and coastal. For simplicity, this Plan will combine flash flooding with urban and small stream flooding under the title of "flash flooding." Since Athens County does not have a Lake Erie coastline, coastal flooding is not an issue.

The largest natural disaster to impact the state of Ohio was a flood in the spring of 1913. While no part of the state was spared, the greatest impact was felt in the southwestern and west-central portions of the state. Two strong storm systems came through the same geographic areas only two days apart. According to Thunder in the Heartland, a total of 467 persons lost their lives. “Never before 1913, and never since, has so much rain fallen over so much of the state in such a short time.” The Flood of 1913 set the record water levels on many Ohio streams.<sup>15</sup>

Southeastern Ohio and Athens County were spared the worst of the flooding from the storms of March 1913. While flooding was severe in 1913, other storms have brought higher flood levels in southeastern Ohio. The largest flood on the Hocking River occurred in March 1907 with other large floods occurring in 1873, 1884, 1937, 1945, 1963, 1964, and 1968. The 1968 flood is considered to be the 1% annual chance flood for the Hocking River and is the second largest historic flood that the Hocking River valley has seen.<sup>16</sup>

Historically, damages from flooding in Athens County have amounted to well over six million dollars.<sup>17</sup> This places flooding as Athens County’s most costly hazard for property damage.

#### Subsection 2g - Flash Flooding

Athens County witnesses flash flooding frequently. Intense thunderstorms will bring creek water out of its banks on an annual basis somewhere in Athens County. Fortunately, the majority of these incidents are inconvenient nuisances, at worst. Occasionally, such as occurred in 1997 and 1998, intense thunderstorms will drop significant rainfall amounts in subwatersheds of the Hocking River. These Hocking River tributaries can rise quickly and with little to no warning. On tributaries as large as Federal Creek and on many smaller tributaries there were reports of “a wall of water” advancing on the homes and towns.

Even the lower Hocking River is prone to rapid rise such as what occurred in the June 1998 flood. The tributaries of the lower Hocking received such intense rainfall that the lower Hocking River exhibited flash flood characteristics. This flood happened at night and there was little to no time for people to remove property from the recreational vehicle camps on the lower Hocking. Fortunately, no lives were lost in Athens County during this flood.

#### Subsection 2h – Riverine Flooding

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<sup>15</sup> Schmidlin, p. 172.

<sup>16</sup> U.S. Army Corps of Engineers, *Floodplain Information, Hocking River, Athens, Ohio*, January, 1972, p. 20.

<sup>17</sup> National Climatic Data Center, a summary of severe weather events.

The flood of 1907 was the highest flood on the Hocking River. “Fire bells began ringing in the Hocking Valley to warn of the impending flood on Wednesday, 13 March. The Athens Journal reported a great flood along the Hocking with several lives lost and a wide disruption of communication and transportation. Dozens of homes in Athens were swept away, overturned, or lifted off foundations. Telephone and telegraph wires were down and the waterworks and electric lights plants were flooded. Rail lines all along the Hocking were cut by the raging river. Large areas of Athens were inundated, causing large losses among business and railroads.....Several commercial buildings at Gloucester (Glouster) were lifted and washed away by Sunday Creek, including three grocery stores, a restaurant, and Will Reese’s poolroom, according to the Athens Journal. Many homes and other businesses were damaged. The coal mines around Gloucester suffered heavy losses. Mine 256 was flooded, resulting in the loss of thirteen horses, machines, motors, cars, and other equipment. All homes in Trimble were flooded.”<sup>18</sup>

As much as 8 inches of rain fell in the Hocking River watershed during 4-10 March 1964 and brought major flooding to Athens County. The Hocking River crested in Athens on March 11 at 24.15 feet. The flood level was the highest since 1907.<sup>19</sup>

Two heavy rain periods within five days of each other brought flooding to the Hocking River valley between May 23<sup>rd</sup> and May 27<sup>th</sup> 1968. Three to six inches of rain fell on already saturated soils on 23-24 May. The Hocking River reached flood stage on May 24<sup>th</sup>.<sup>20</sup> The rapid rise of waters from this flood prevented residents from moving personal belongings out of harm’s way. Even though riverine flooding happens more slowly than flash flooding, it is apparent that floodwaters on the Hocking River can still rise rapidly enough to catch people off guard.

## Subsection 2i – Hail

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<sup>18</sup> Schmidlin, pp. 170-171.

<sup>19</sup> “Athens County schools dismissed early to allow buses to deliver children home before roads were flooded by rising rivers, and Ohio University students removed their cars from basement garages at West Green dormitory. National Guard troops, firemen, and police worked through the night to evacuate residents of Rockbridge and South Logan upstream along the Hocking River.....All schools and main highways were closed in the region on Wednesday, mail delivery was curtailed, fifteen hundred Ohio University students were evacuated, and 380 Athens homes were flooded, according to the *Athens Messenger*.” (from Schmidlin, p 208.).

<sup>20</sup> “The Hocking River reached 24.63 feet at Athens, more than 7 feet above flood stage and the highest since 1907. All communities along the Hocking were flooded, and roads, schools, businesses, and factories were closed throughout the river basin. Amesville businesses were flooded and for the first time in memory, there was water on the floor of the First National Bank Building. Three feet of water in Amesville Nursing Home forced residents to the second floor. The *Athens Messenger* reported that a helicopter delivered food to the stranded nursing-home residents. Homes were evacuated and highways blocked in Nelsonville, Murray City, Logan, Rockbridge, and Chauncey. The quick overnight arrival of the flood prevented residents from moving household goods to higher positions and, even when goods had been moved, they often had not been raised high enough.

The flood came at a time of tension on university campuses as students protested the Vietnam War. Ohio National Guardsmen were on duty at Ohio University as a precaution against civil unrest, but instead they saw duty in the flood. The *Athens Messenger* reported that ‘it was strange to see the Guardsmen and students working together in the flood’ when only days before they had been antagonists.”(Schmidlin, p. 212.).

Hail forms in thunderstorm clouds as water drops are cooled to form ice pellets and additional water is frozen onto the small pellets in ever larger concentric circles. Strong updrafts allow the pellets to stay aloft for long periods and grow into hailstones. While all thunderstorms contain hail, few thunderstorms produce hail that reaches the ground because it melts back to rain before reaching the earth.<sup>21</sup>

A thunderstorm can produce hail for several minutes leaving a “hailstreak” one-half mile or more wide and several miles long. A slow moving thunderstorm can produce hail for twenty minutes leaving hail to a depth of one foot. Any location in Ohio can expect hail on an average of two days per year. Most hail is small and causes no damage except bruising of fruits and vegetables. Hail one inch or more in diameter can cause dents in cars and aluminum siding, break windows, tear awnings, strip leaves from trees, and destroy crops. Animals have been killed by large hail and persons have sustained injuries from large hail. Hail in Ohio has been recorded at up to three inches in diameter.<sup>22</sup> According to the NCDC report, hail caused \$230,000 damage in Athens County in 2002 and a total of \$285,000 damage in the years 1982 to 2002.

#### Subsection 2j – High Wind

According to Thunder in the Heartland, minor damage to property and vegetation begins with winds at speeds as low as forty five to fifty mph. Trees are uprooted or snapped off by winds at sixty to seventy mph. Additionally, shingles are blown from roofs, windows are broken, electric and telephone lines are blown down, and mobile homes may be pushed off foundations or overturned. At wind speeds greater than one hundred mph, large trees are uprooted or snapped off, moving cars are blown off roads, mobile homes are demolished, and roofs are blown from frame houses. Winds of more than one hundred fifty mph tear roofs and walls from well-built frame homes, toss cars through the air, and topple entire forests.<sup>23</sup>

Besides tornadoes there are two types of damaging winds in Ohio, large-scale and microburst. Large scale winds with speeds greater than fifty mph may occur behind a cold front associated with an intense low pressure system. Such winds may cover an extensive area and last for several hours. Microbursts are strong downdrafts, associated with thunderstorms. They can be as large as one mile wide and two to three miles long. The winds descend from a thunderstorm, strike the ground, and spread out in a fan shape.<sup>24</sup>

Athens County has had a number of high wind events according to the NCDC Storm Events Report. The report showed that a severe high wind event occurred on August 9, 2000 in which eight people were injured. The Athens Messenger, in an article titled *Storm collapses tent; 8 injured*, August 10, 2000 reported “a powerful thunderstorm

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<sup>21</sup> Schmidlin, p. 303.

<sup>22</sup> Schmidlin, pp. 303-304.

<sup>23</sup> Schmidlin, p. 227.

<sup>24</sup> Schmidlin, p. 227.

caused the collapse of a tent covering the swine show ring at the Athens County Fairgrounds...At least eight people were treated by O’Bleness Memorial Hospital for personal injuries.”

#### Subsection 2k – Ice Storm

An ice storm occurs when precipitation occurs as rain but below-freezing temperatures on the ground cause the rain to freeze onto any objects with which it comes in contact. Ice storms create hazardous driving and walking conditions and can add significant weight to overhead utility cables and tree branches.

The average air temperature at ground level is 30 degrees during freezing rain but this phenomenon can occur at temperatures as low as 15 degrees. Freezing rain occurs in bands 25 to 100 miles wide, oriented west to east as a low pressure system and accompanying warm front approach from the south or southwest. Freezing rain only lasts an hour or two because the weather systems move through at thirty to fifty miles an hour. Prediction of ice storms is difficult because a slight temperature change at the ground surface can move the location of the ice storm more than 100 miles. Forecasting of the location and amount of ice accumulation is not precise.<sup>25</sup>

Two ice storms in early 1994 created havoc in southeastern and southern Ohio as electric utility lines were damaged from the weight of ice and from tree limbs falling on them. Widespread power outages occurred. Falling tree limbs damaged automobiles and houses. According to the NCDC, forty people were injured and damages were estimated at \$10 million for these two events. The President’s Day Storm of 2003 dropped up to two feet of snow in Athens County but counties south of Athens, where temperatures were warmer, had significant ice accumulation that knocked out electrical power for over one week in some situations.

#### Subsection 2l – Landslide/Rockfall

Landslide is the “...downward and outward movements of slopes due to rains or melting snow with accompanying damage and debris deposition.”<sup>26</sup> As used in this section, landslide is the term that will describe all downslope movement of earth with the exception of rockfall which is the relative free-fall of rocks down a vertical or very steep slope. Downslope movement of earth has been grouped into several categories based on rate of movement and the type of geologic material associated with the movement. The types common to Athens County are rockfall, debris fall, slump, earthflow, and creep.<sup>27</sup>

There are many causes of slope movements, but they can be grouped into two general categories, geologic conditions and triggering actions. The geologic conditions are steep slopes, angle of rock layers, highly fractured rock, abundance of ferric oxide (red colors) in clay or clay shales porous or permeable rock, soluble rock, water soluble

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<sup>25</sup> Schmidlin, p.7.

<sup>26</sup> Hazard Analysis and Risk Assessment, OEMA, p. 19.

<sup>27</sup> The Prediction of Unstable Slopes in Southeastern Ohio, John W. Sowers, August, 1975, P. 16.

cementing agents associated with certain rocks such as sandstone, presence of clay seams, clay soils, or clay shales subject to groundwater lubrication, and an influx of water from rain or drainage. The triggering actions are vibrations either natural or manmade, oversteepening of slopes, removal of lateral support at the toe of a slope, the collapse of drift mine workings, the weighting of the upper portion of a slope with fill or buildings, removal of vegetation from a slope, and water in excess that adds weight, dissolves rock, lubricates clay seams and increases pore water pressure in the soil.<sup>28</sup>

The U.S. Geological Survey produced a map showing landslide incidence and susceptibility. The eastern one-third of Athens County shows a moderate incidence (1.5% - 15% of the total area involved) of landslide but a high susceptibility (greater than 15% of the area involved) to landslide. This means that while there is a significant percentage of land that may be prone to landslide, the movement actually occurs on a much smaller percentage of the overall area. The western two-thirds of Athens County shows a high susceptibility (greater than 15% of the area involved) but a low incidence (less than 1.5% of the area involved) of landslide.

Records of landslide on state highways are kept by ODOT at the District level. District 10, which includes Athens County, lists 180 – 200 landslides per year compared with 15 for District 8 (southwestern Ohio), 12 for District 9 (southern Ohio), and 20 for District 11 (eastern). County, township, and municipal highway departments also spend considerable resources trying to prevent and having to repair landslides.

In addition to expenses for the maintenance and repair of streets and roads impacted by landslide, building foundations and utility lines are also affected. Buildings can be rendered useless and worthless if negatively impacted by landslide to a great enough extent. Landslides and rockfall can also be dangerous if they destroy a house that is occupied or destroy a roadway giving no advance warning to an unsuspecting motorist.

#### Subsection 2m – Land Subsidence

Land subsidence is the settling of the earth's surface due to the loss of underground geologic support. In Athens County, this loss of support is associated with past underground coal mining activity. Old coal mines used the room and pillar mining technique whereby the majority of coal was removed creating large "rooms". Enough coal was left as "pillars" in an attempt to support the overburden or roof of the mine. Pillars were often removed at a later time or pillars that remained have deteriorated and lost strength. In these cases or if the roof rock above the mine is weak and fractured, the weight of the rock and earth above the mine will collapse them into the mine and impact the surface.

Land subsidence can destroy buildings, roads, and infrastructure. While Athens County has not had a subsidence that has destroyed a major highway or caused extensive damage to any buildings, the presence of abandoned underground mines is a threat to be recognized. Residents of Athens County are required to purchase mine subsidence

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<sup>28</sup> Ibid., pp. 21-22.

insurance at a cost of \$1 per year. Coverage is the lesser of \$50,000 or the actual cost of repairs to the home. The ODNR Division of Mineral Resources Management tracks subsidences and subsidence complaints. Some complaints of ground settling or foundation damage to homes are not actually caused by underground mines and this must be determined by the Division of Mineral Resources before a claim can be paid since only subsidence from abandoned mines is eligible for insurance reimbursement.

The Natural Hazards Risk Map (Appendix 9) shows the areas in Athens County that are susceptible to subsidence. The ODNR Division of Mineral Resource Management can provide information about subsidences that have occurred in any given area of the state. The Division has also produced a booklet, Ask Before You Build, that serves as “a guide for landowners, developers and local officials to better assess abandoned mine lands before building.”

#### Subsection 2n – Thunderstorm and Lightning

Thunderstorms and lightning are mentioned as a separate category even though the subsections entitled High Wind and Flash Flooding cover some of the hazard issues. A thunderstorm often brings all three hazards; high winds, lightning, and intense rainfall. Two deaths and one injury were caused by lightning in Athens County in the mid 1990's. Damages from lightning in 1995 and 2001 totaled \$81,000 in Athens County.

#### Subsection 2o - Tornado

Athens County is located in the Wind Zone IV, and has a high risk of extreme winds rating. One tornado and varying levels of windstorms have been recorded in Athens County, all resulting in limited damages. Predicting what parts of Athens County have a greater chance of being struck by a tornado, however, is difficult. Tornadoes can strike with very little warning.

Maps obtained from *FEMA's Taking Shelter from the Storm: Building a Saferoom in Your House* (<http://www.fema.gov/fima/tsfs13.shtm>) were used to determine the wind speed zone and tornado activity of Athens County. According to the map *Wind Zones in the United States*, Athens County is in the Zone IV (250 mph) wind zone. The map, *Tornado Activity in the United States*, shows that between 1 and 5 tornadoes were recorded per 1,000 square miles from Athens County. By using FEMA's *Assessing Your Risk* chart, Athens County is calculated to be in the high level of risk from extreme winds.

A search done through Tornado Project Online at <http://www.tornadoproject.com> found one recorded tornado occurring between 1950 and 1995 in Athens County. The May 12, 1980 tornado had no recorded deaths or injuries. It measured F1 on the Fujita Tornado Measurement Scale. F1 tornadoes are classified as moderate tornadoes (73-112 mph winds) causing moderate damages.

The Historic Tornado Touchdown Map (Appendix 10) was produced using the ESRI/FEMA Project Impact Hazard Site. This map shows the May 12, 1980 tornado occurring in Athens County with a severity level of 1 on the Fujita scale. A tornado rated at level 5 on the Fujita scale hit Gallia County on April 23, 1968 according to the National Climatic Data Center. The National Climatic Data Center also indicated that six people have died from four southeastern Ohio tornado incidents dating from 1886. While this hazard has proven extreme, incidents are extremely rare and for this reason it did not receive a higher risk rating. No deaths were recorded for Athens County from any tornado events.

#### Subsection 2p – Winter Storm/Blizzard

Winter storm and blizzard are combined into one hazard. Winter storms are typically associated with heavy snowfall and windy conditions. Blizzards are extreme winter storms that have snowfall, high winds, and extreme cold. The high winds in blizzard conditions create poor visibility and dangerous driving conditions even if snowfall is not heavy because dry snow can be blown around giving the effect of heavy snowfall. Some of the dangers associated with winter storms and blizzards are falling tree limbs, dangerous driving, utility outages, extreme cold, and collapsed roofs.

There are several storm systems that can bring snow to southeastern Ohio. Those originating in the Canadian prairies are known as Alberta Clippers. Other places of origin are the Southern Plains, the Gulf of Mexico, and the Atlantic Coast. Very heavy snowfall can occur if moisture from the Gulf is drawn up into cold air sitting over Ohio. The heaviest snowfall occurs in a band less than one hundred miles wide so less than half of Ohio is usually affected by any single storm. Snowfall of six inches or more is considered a heavy snowfall in Ohio. This depth is expected once or twice a year in northern Ohio and only once every two or three years in extreme southern Ohio. Ohio's greatest snowfall amounts from a single storm have occurred in Ohio's eastern counties where storms moving along the Appalachian mountains bring in moisture from the Atlantic Coast. Twenty to thirty inches of snow can fall during these events.<sup>29</sup>

Athens County is on the edge of this area and can receive large quantities of snow if conditions are appropriate. The Thanksgiving snowstorm of 1950 is an example. Athens County received between twenty and twenty-five inches of snowfall during the storm.<sup>30</sup>

#### Subsection 2q - Wildfire

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<sup>29</sup> Schmidlin, p.6.

<sup>30</sup> “At Marietta, where weather records extend back to the early 1800’s, the *Marietta Daily Times* reported the twenty-seven inches in this storm was the greatest in any known record here. . . . The press reported up to seventy persons were killed in Ohio by the storm, mostly from overexertion and heart attacks.”, Schmidlin, pp. 39-40.

The peak seasons for wildfire in Southeastern Ohio are March, April and May, before vegetation “greens-up” and October and November, after leaf drop. These are the months when warm, windy, low humidity conditions are prevalent and vegetation is more susceptible to burning. Other factors that determine an area’s susceptibility to wildfire include topography and fuel. Slopes greater than 60 degrees have a high vulnerability to wildfire, slopes between 40 and 60 degrees are considered moderate and slopes less than 40 degrees have low wildfire susceptibility. Ground fuel is vegetation and woody debris that is found underneath the forest canopy. Areas with a large amount fuel are more at risk of damaging wildfire than areas relatively clean of undergrowth. A fuel model map of the U.S was found at ([www.fs.fed.us/land/wfas/nfdr\\_map.htm](http://www.fs.fed.us/land/wfas/nfdr_map.htm)), but at this time the accompanying data information is unavailable.

Research on the occurrence of previous wildfire in Athens County was done and produced evidence that in 1999, Southeastern Ohio was plagued with forest fires. There were a reported 31 wildfires in Athens County which burned 112 acres. No significant structural damage occurred. In comparison, in year 2001 Athens County experienced 22 fires which burned only 49 acres. These statistics can be found at ([www.ohiodnr.com/forestry/Fire/wildstats.htm](http://www.ohiodnr.com/forestry/Fire/wildstats.htm)). Other extensive internet and library research produced no evidence of devastating wildfire in Athens County which caused significant human injury or structural damage.

Based on the history of wildfire in Athens County the risk of a devastating wildfire event to occur appears to be relatively low. However, some conditions, namely steep and vegetated slopes, that are associated with wildfire vulnerability are found in Athens County. The County does not have a wildfire risk map. Production of a risk map for wildfire is an activity in the County’s five year natural hazard mitigation plan.

## Chapter 3

# Vulnerability Assessment

### Section 1 – Asset Identification

The purpose of asset identification is to make County leaders and residents aware of the extent of vulnerability to natural hazards. Numbers of residents and numbers of structures and their values are analyzed to arrive at potential loss estimates. The term “asset”, for purposes of this Plan, was primarily used to mean building. Rolling stock, other equipment, and critical facilities were not included in the replacement cost calculations.

The 2000 census revealed a population of 62,223 and a housing count of 24,901 with 22,501 units occupied and 2,400 units vacant. Data available from the County Auditor made it possible to obtain the replacement costs of single family homes. County Auditor data was not available in digital format for industrial, public, or commercial structures.

#### Single Family Residential Property

The County Auditor listed 7,086 structures as residential real estate. The replacement value of these structures is \$661,718,570 and the average replacement value computes to \$93,384. Estimates were also made for the number of mobile homes (singlewides and doublewides) in the County. These estimates were made by using aerial photography to analyze a random sample of 50 parcels, out of a population of 2,003 parcels, that were listed as containing mobile homes. The results of the sample analysis were that 16 parcels contained no mobile homes<sup>31</sup>, 13 parcels contained 1 singlewide, 6 parcels contained 2 singlewides, 2 parcels contained 3 singlewides, 9 parcels contained 1 doublewide, 3 parcels contained 2 doublewides, and 1 parcel contained both a singlewide and a doublewide. Using this information, the entire population of mobile homes is estimated at 1,281 singlewides and 641 doublewides.

The replacement value for a mobile home was determined by contacting a local mobile home dealer.<sup>32</sup> The replacement value of a single-wide mobile home is \$25.97 per square foot based on a sale price of \$24,000 for a home measuring 66'X14'. The replacement value of a doublewide mobile home is \$36.46 per square foot based on a sales price of \$35,000 for a home measuring 40'X24'. The total value of 1,281 singlewides is \$30,744,000. The total value of 641 doublewides is \$22,435,000. The total of real estate and mobile home replacement costs is therefore \$714,897,570.

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<sup>31</sup> They may have been moved off the property and the Auditor's records do not yet indicate this.

<sup>32</sup> Brian Call, salesman, at Dupler's Homes on US Rt 33, Nelsonville, OH.

## Commercial Property

The County Auditor's commercial property database includes apartments, temporary lodging, and mobile home and RV Parks. A random sample of 50 commercial parcels was analyzed. Structures on the 50 parcels were measured for square footage using a GIS program. FEMA's per foot replacement costs were then supplied to yield a total replacement cost of \$21,202,167 or an average of \$424,043 for the sample. Applying the average to the population of 403 commercial parcels yielded a total replacement cost of \$170,889,329.

## Industrial

A total of 19 parcels were listed as industrial. Measuring the square footage of building space and utilizing replacement cost values yielded a total value of \$14,282,552 for industrial structures.

## Other

It is assumed that 50% of the residential dwellings (real estate plus mobile homes) have an accessory building with them and that the average replacement value of these accessory buildings is \$10,000. There are an estimated 4,504 such structures and it is estimated that they have an average replacement cost of \$10,000 placing their total replacement cost at \$45,040,000.

## Exempt Property

The County Auditor listed a total of 323 parcels as the population of exempt property. This includes all public and non-profit buildings such as fire stations, schools, and public works. Taking a random sample of 50 such parcels and utilizing FEMA's replacement cost values yielded a total replacement cost of \$5,455,475 and an average replacement cost of \$109,109 for the sample. The total replacement cost for the population of 323 parcels is therefore \$35,242,207.

## Critical Facilities

The Federal Emergency Management Agency defines critical facilities as:

- Essential-these are necessary for the health and welfare of everyone and are particularly needed after a disaster. Examples are hospitals, police and fire stations, emergency operations centers, and evacuation shelters.
- Transportation-examples include airports, bridges, railways, and roadbeds.
- Lifeline Utilities-examples are water and wastewater systems, oil, natural gas, electric power and communication systems.
- High Potential Loss Facilities-these would have a high loss (life and/or property) associated with their destruction. Examples include dams and nuclear power plants.

- Hazardous Materials Facilities-these house industrial hazardous materials such as corrosives, explosives, flammables, radioactive materials, and toxins.

Appendix 11 lists critical facilities for Athens County. Essential services, transportation facilities, and lifeline utilities are rated according to how important it is that the facility remain functional during a natural hazard event. High potential loss facilities are rated according to likelihood of failure and degree of loss of life and property in the event of failure. Hazardous materials facilities are rated according to the degree of hazard posed should a release occur. Additionally, the facilities have listed which geographic-specific hazard (flood or landslide), if any, affects them. It is assumed that any of the non-geographic-specific hazards could affect any of the facilities.

Due to the number of critical facilities in the County and the limited time available for plan preparation, critical facilities replacement costs were not analyzed. One of the activities for the five year mitigation effort will be to analyze replacement costs for high priority facilities in the floodplain.

The following table summarizes the replacement values of the County's assets<sup>33</sup>:

Asset Type	Total Number	Average Replacement Value	Total Replacement Value	Total Contents Value
Single Family Residential				
Real Estate	7,086	\$93,384	\$661,718,570	\$330,859,285
Singlewide Mobile Homes	1,281	\$24,000	\$30,744,000	\$15,372,000
Doublewide Mobile Homes	641	\$35,000	\$22,435,000	\$11,217,500
Commercial	403	\$424,043	\$170,889,329	\$170,889,329
Industrial	19	\$751,713	\$14,282,552	\$21,423,828
Other	4,504	\$10,000	\$45,040,000	\$22,520,000
Exempt	323	\$109,109	\$35,242,207	\$35,242,207
TOTALS	14,257		\$980,351,658	\$607,524,149

<sup>33</sup> Critical facilities that are buildings are included under commercial or public assets. Time did not permit a replacement cost analysis for critical facilities that are not buildings. Therefore, the total number presented is low since high cost items such as bridges, water towers, water wells, and utility pumping stations were not included.

## Section 2 – Potential Loss Estimates

### Background

For purposes of this plan, only the high risk, geography-specific hazards were used to calculate potential losses. The Committee believed that limited planning resources are better spent on planning for those hazards with a higher degree of risk (probability X impact) than spreading thin those same resources over all the hazards. Most resources were spent on the riverine and flash flooding hazard since they pose the greatest risk. Blizzard is also a high risk hazard but does minimal damage to physical assets. It is a far greater risk to human life and safety. High winds, thunderstorm/lightning, extreme cold, extreme heat, and ice storm are medium-risk hazards that have not created major damages to residential and commercial structures but pose serious threats to human life and to lifeline utility systems.

### Flooding (Riverine and Flash)

A Geographic Information System (GIS) is a powerful tool for use in calculating losses from specific natural hazard events. Particularly for geography-specific hazards, a GIS can readily locate assets that lie within certain hazard zones. GIS was used to isolate assets in flood zones.<sup>34</sup>

In the County's 1% annual chance floodplain there are 358 single family residential and small multifamily<sup>35</sup> structures, 153 mobile homes, 57 commercial<sup>36</sup> buildings, 4 industrial buildings, 50 exempt buildings, and 228 other buildings. Planning resources did not allow for a detailed study of lowest floor elevations, one of the items needed to use FEMA's Loss Estimation Tables. The County also has many "A" zones on its floodplain maps so 1% annual chance flood elevations are not known. Flood elevation is the second item needed to use the Loss Estimation Tables.

For purposes of loss estimation for the flood hazard, figures of 20% building loss (63% for mobile homes) and 30% contents loss (90% for mobile homes) were chosen.<sup>37</sup> These figures were chosen because they are reflective of two other asset loss studies that were performed in Athens County. The Village of Trimble had a structure loss of 34% of total replacement cost and a contents loss of 48% of total contents value. The City of Athens had a structure loss of 6% of total replacement cost and a contents loss of 9% of total contents value. The County's percentage losses would be in between the City's and the Village's because the County and the City, unlike the Village of Trimble, do not have major percentages of their assets in floodplain areas where high flood depths are expected. The City and County have also had very active floodplain management programs that help to minimize losses. However, the County's settlement pattern and

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<sup>34</sup> The GIS flood zone was created by a process of digitizing the FEMA Flood Insurance Rate Maps.

<sup>35</sup> Converted single family homes and duplexes

<sup>36</sup> Includes apartments, temporary lodging, and mobile home parks

<sup>37</sup> Figures taken from FEMA's Loss Estimation Tables for a one or two story building with a basement and for mobile homes, all with a flood depth of two feet above the lowest floor elevation.

value and type of assets has something in common with the Village so that its loss figures would be accordingly higher than those of the City of Athens.

Loss figures for the flood hazard in Athens County can be estimated and summarized as follows:

Asset Type	Total Number in Floodplain	Average Replacement Value	Total Replacement Value in Floodplain	Total Contents Value in Floodplain
Single Family Residential				
Real Estate	358	\$ 93,384	\$33,431,472	\$16,715,736
Singlewide Mobile Homes	101	\$ 24,000	\$2,424,000	\$1,212,000
Doublewide Mobile Homes	52	\$ 35,000	\$1,820,000	\$910,000
Commercial	57	\$ 424,043	\$24,170,451	\$24,170,451
Industrial	4	\$ 751,713	\$3,006,852	\$4,510,278
Other	228	\$ 10,000	\$2,280,000	\$1,140,000
Exempt	50	\$ 109,109	\$5,455,450	\$5,455,450
TOTALS	850		\$72,588,225	\$54,113,915
Asset Type	% Structure Loss	Structure Loss	% Contents Loss	Contents Loss
Single Family Residential				
Real Estate	20%	\$ 6,686,294	30%	\$ 5,014,721
Singlewide Mobile Homes	63%	\$ 1,527,120	90%	\$ 1,090,800
Doublewide Mobile Homes	63%	\$ 1,146,600	90%	\$ 819,000
Commercial	20%	\$ 4,834,090	30%	\$ 7,251,135
Industrial	20%	\$ 601,370	30%	\$ 1,353,083
Other	20%	\$ 456,000	30%	\$ 342,000
Exempt	20%	\$ 1,091,090	30%	\$ 1,636,635
TOTALS		\$ 16,342,565		\$ 17,507,375
Total Structure & Contents Loss			\$ 33,849,940	

#### Winter Storm/Blizzard

The losses from a winter storm or blizzard are not geographically predictable within Athens County. Severe blizzard conditions have caused loss of life in Ohio but it is also difficult to predict such an occurrence. For purposes of calculating potential loss from a winter storm or blizzard, an economic indicator will be used. It is assumed that a severe blizzard will effectively shut down all but emergency and essential operations within Athens County for a one week period.

The unincorporated area of Athens County has a population of 29,519 and 9,188 households with job earnings. These 9,188 households earn a total of \$393,372,846 in

annual income or \$7,564,862 each week. If we assume that 95% of the work force will be away from work for one week in the event of a severe blizzard, the unincorporated portion of Athens County will lose the productive equivalent of \$7,186,619 in wages.  
Section 3 - Development Trend Analysis

The population for Athens County is only expected to increase slightly over the next decade. The following table shows population figures in the 1900's for the County:

<b>Place</b>	<b>1900</b>	<b>1910</b>	<b>1920</b>	<b>1930</b>	<b>1940</b>	<b>1950</b>
<b>Athens County</b>	38,730	47,798	50,430	44,175	46,166	45,839
<b>State of Ohio</b>	4,157,545	4,767,121	5,759,394	6,646,697	6,907,612	7,946,627
<b>29 Appalachian Counties</b>	971,844	1,017,030	1,056,812	1,075,512	1,130,970	1,133,978

  

	<b>1960</b>	<b>1970</b>	<b>1980</b>	<b>1990</b>	<b>2000</b>
<b>Athens County</b>	46,998	54,889	56,399	59,549	62,223
<b>State of Ohio</b>	9,706,397	10,652,017	10,797,630	10,847,115	11,353,140
<b>29 Appalachian Counties</b>	1,226,559	1,237,660	1,376,130	1,372,893	1,455,313

The economy of Athens County is largely dependent upon Ohio University. The University provides stability because it is not affected by swings in the economy as much as other businesses. University enrollment is likely to increase slightly over the next decade but should not have any major impacts on development issues in Athens County.

Several new subdivisions are proposed in the County. These proposed developments are within three miles of the City of Athens so the City Planning Commission has review authority with advice from the County Regional Planning Commission. Floodplain and landslip issues are closely examined by both Planning Commissions before subdivision approvals are given.

The Village of Albany, in the southwest corner of Athens County, will get a public sewer system in two years. There will be development pressure from this new system as subdivision proposals are already being discussed. The area between Athens City (center of the County) and the Village of Albany is likely to have some growth from subdivisions. The two housing developments discussed in the previous paragraph are in this region. In general, this region does not have the flooding and landslip problems seen in other parts of the County.

An area experiencing some commercial activity is along U.S. Route 50 east of the City of Athens. Floodplain areas along the Hocking River are filled and businesses are established. A lot of this area is still mapped as "A" zone<sup>38</sup> and this poses a problem for floodplain management. The County is working towards getting this area mapped. The AFRRRI program mapped at least one mile of stream length in this area and developers

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<sup>38</sup> A zones show approximate floodplain boundaries but do not have flood elevations or floodways established.

proposing larger than 5-acre developments also have to provide mapping and flood elevations on their properties. The County requires a six-inch freeboard<sup>39</sup> in areas where flood elevations are known.

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<sup>39</sup> Freeboard is the height above the base flood elevation to which a building's lowest floor must be elevated. It is an added measure of protection since the base flood elevation may increase over time due to development in floodplain areas.

# Chapter 4

## The Plan

### Section 1 – Goals, Objectives, and Activities

The Plan Committee followed a process of identifying a desired state or a series of desirable conditions of reduced risk to natural hazards. With good planning and a will to achieve, the County could better survive a natural hazard than they have previously. In addition to the list of desired conditions, a second list of problem statements, or reasons why the desired state could not be achieved, was developed (see Appendix 12 for a list of problem statements by hazard type).

The desired state and problem statements were then used to formulate two overarching goals and a series of nine objectives. Subsequently, activities to meet the objectives were developed. The activities each have a time frame, a cost, and an individual or group who is responsible for implementing the activity.

### Section 2 – Implementation Through Existing Programs

The Table in Appendix 13 shows the goals, objectives, and activities adopted for the natural hazard mitigation plan. One of the key activities is the continuation of the natural hazard planning committee. The Athens County Regional Planning Commission, the Athens County Emergency Management Agency, and the County 9-1-1 Office will work cooperatively and utilize assistance from organizations such as the Red Cross to implement the County mitigation plan.

Athens County does not currently have a comprehensive plan. Athens County will implement the natural hazard mitigation plan through existing programs by continuing to involve local government departments and leadership on the natural hazard mitigation planning committee. Many of the local government entities that influence mitigation efforts are identified as the responsible party for implementing activities listed in Appendix 13 of this plan. Some of the activities that will require implementation through existing programs include Goal 1, Objective 3, Task 6a and Goal 2, Objective 2, Tasks 1-4. The county will also review the Capital Improvement Plan on an annual basis to insure compliance with the goals and objectives of the Natural Hazard Mitigation Plan.

Athens County has several planning and plan implementation mechanisms in place. An active planning commission meets once per month and has active participation from the City/County Health Department, the County Engineer, and the County Commissioners. Specific examples of the County's role in planning include:

- The Regional Planning Commission employs a full time planner and administrative assistant.
- The Regional Planning Commission considers floodplain, drainage, and landslip issues when it reviews new development proposals.
- The Regional Planning Commission has made floodplain management a major priority for its staff.

- An active geographic information system that provided the data for preparation of this mitigation plan.

Continued compliance with the NFIP will be maintained with the follow strategy:

- The Athens County Regional Planning Commission will continue to be the permitting and enforcement entity for the County's floodplain management program.
- County staff will attend continuing education seminars to stay up to date with floodplain management.
- Post-disaster substantial damage assessments will be performed in a timely and thorough fashion.
- An ongoing information and education program will keep citizens informed about the flood hazard and how to minimize it.

### Section 3 – Maintenance

It is the intent of Athens County to update the Natural Hazard Mitigation Plan every five years. This will be an ongoing process that includes the following:

- Quarterly meetings of the natural hazard plan committee. More meetings or subcommittee meetings will be held as needed (this may be required in the first year in order to get the program off the ground).
- Insuring that the County EMA, Regional Planning Commission, and County 9-1-1 Office coordinate mitigation planning with villages and cities, particularly Athens City and the Village of Trimble, within Athens County. The EMA Director and the County Planning Director will sit on the mitigation plan committees of Athens City and Trimble Village and will work with these entities to implement their plans.
- An annual report to the County Commissioners by the natural hazard planning committee will keep the elected officials updated and be an opportunity to publicize the committee's work. The report will focus on accomplishments, the next year's work plan, and recommended changes to the Plan. This will serve as an opportunity for public participation as the meeting will be announced in the media. A written report will also be available and accompany the meeting presentation.