2.0 Hazard Analysis

Hazard analysis is the foundation upon which all emergency planning efforts in the community are built. Hazard analysis provides an understanding of the potential threats facing the community. By pinpointing the exact location, extent and magnitude of past disasters and by examining new or emerging risks, it is possible to determine the probability of such events occurring and the vulnerability of people and property. By reviewing this information along with relevant land use, geographic, economic, and demographic information, local officials can make assumptions about which segments of the community might be impacted by various types of hazards. This in turn allows them to set priorities and goals for mitigation prior to an incident occurring.

Hazard analysis can be broken down into four basic steps:

1. Identify the hazards.
2. Profile each hazard.
3. Develop a community profile.
4. Conduct a vulnerability analysis and estimate losses.

2.1 Identification of Hazards

The first step in hazard analysis involves the identification of those natural hazards to which the community is susceptible. To help determine which natural hazards affect Henry County, a number of different methods were employed. They included a questionnaire and a search of historical records for past hazards that occurred in Henry County. The questionnaire was completed by the core committee, sent to all of the townships and municipalities and was given to the general public at the Henry County Fair in August 2003.

The questionnaire asked "How concerned are you about the following disasters affecting Henry County?" The hazards listed included drought, earthquake, flood, thunderstorm/lightning, wild fire/forest fire, wind storm/tornado, winter storm/blizzard and other. The response was based on a level of concern ranging from extremely concerned (1) to not concerned (5). The results of the questionnaire indicated the following:

Hazard	Percentage Indicating Extremely or Very Concerned
Wind storm/tornado	64%
Winter storm/blizzard	62%
Thunderstorm/lightning	54%
Flood	38%
Drought	26%
Wild fire/forest fire	10%
Earthquake	2%

To determine what past hazards have occurred in Henry County, a number of different sources of information were reviewed. They consisted of newspapers, history books in

the library, National Oceanographic and Atmospheric Administration (NOAA) website, United States Geologic Survey (USGS) website, and Federal Emergency Management Agency (FEMA) website. Information was also obtained from citizens with historical information and governmental agencies that have natural hazard information. Other plan reviewed included the Henry County Comprehensive Plan and the Henry County Emergency Operations Plan.

The following table identifies the hazards that were determined to be most prevalent in Henry County.

Hazard	How identified	Why identified
Tornado	• Public Input • Review of Past disasters • Risk Assessments	• Frequently causes damage
Winter storm/blizzard	• Public Input • Review of Past disasters • Risk Assessments	• Frequently causes damage
Thunderstorm	• Public Input • Review of Past disasters • Risk Assessments	• One of the forces causing flooding • Frequently causes damage
Flood	• Review of FIRMs • Public Input • Review of Past disasters • Risk Assessments	• Flooding occurs along a numbers of rivers and creeks throughout the County • There are structures within areas that are identified as a special flood hazard area

Other hazards that were evaluated included droughts, wildfires and earthquakes, but were determined to be a low risk to Henry County. The results of the evaluation are included in the following paragraphs.

2.1.1 Drought

Drought refers to an extended period of time with deficient rainfall relative to the statistical mean for a region. The severity of a drought is dependent on its duration, intensity and geographic extent. During severe droughts, agricultural crop yields are reduced and a shortage of water for human and industrial consumption can occur. With a majority of Henry County being agricultural and

with a number of houses on wells for their water supply, droughts can and have affected Henry County. However, it is also difficult to determine losses from droughts and to accurately predict future occurrences and magnitude.

2.1.2 Wildfire/Forest Fire

A wildfire is an uncontrollable fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that fills the area for miles around.

Wildfire behavior is based on three primary factors: fuel, topography and weather. The type and amount of fuel, as well as its burning qualities and level of moisture, affect wildfire potential and behavior. The continuity of fuels expressed in both horizontal and vertical components is also a factor, in that it expresses the pattern of vegetative growth and open areas. Topography is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the rate of speed at which fire travels. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind (both short and long term) affect the severity and duration of wildfires.

Even though Henry County has heavily wooded areas such as the Maumee State Forest and Mary Jane Thurston State Park, the weather conditions and the flat topography minimize the risk of wildfires. The biggest hazard for wildfires in Henry County is when land owners burn ditch banks and the fire gets out of control and burns the vegetation in the field.

2.1.3 Earthquakes

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates. The severity of these effects is dependent on the amount of energy released from the fault epicenter. Common effects of earthquakes are ground motion and shaking, surface fault ruptures, and ground failure.

One way to measure earthquakes is by determining peak ground acceleration (PGA). PGA is a measurement of the strength of ground movements. The website http://geohazards.cr.usgs.gov displays information regarding the probability of earthquakes and their severity. Based on the Peak Acceleration (%g) with 10% Probability of Exceedance in 50 years, USGS Map, October 2002, the value for Henry County is approximately 2.8% g (which is relatively low). This means that an earthquake with a PGA of 2.8% has a 10% chance of being exceeded over a 50-year period.

Historically, Henry County has experienced earthquakes, but they have been small, and damage has been minimal.

Even though droughts, earthquakes and wildfires have occurred or could occur in Henry County, the core committee determined that these hazards were a low risk for Henry County.

Appendix A of this plan includes the Vulnerability Map and Electric System Map that shows the location of the county's infrastructure, critical facilities and structures within the special flood hazard areas.

2.2 Profiling Hazard Events

Based on the identification of what natural hazards can occur in Henry County, it was determined that the most prevalent are tornadoes, winter storm/blizzards, thunderstorms and flooding. To get an indication of how bad these natural hazards can get, research on past hazards was completed. The following information contains past natural hazard events.

2.2.1 Tornado

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long.

Tornadoes are among the most unpredictable of weather phenomena. While tornadoes can occur almost anywhere in the world, they are most prevalent in the United States. Tornadoes can occur in any state but are more frequent in the Midwest, southeast and southwest. Tornado season runs ordinarily from March through August; however, tornadoes can strike at any time of the year, if the essential conditions are present.

Fujita Tornado Measurement Scale		
F0	Gale tornado (40-72 mph)	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
F1	Moderate tornado (73-112 mph)	Moderate damage. The lower limit is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
F2	Significant tornado (113-157 mph)	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	Severe tornado (158-206 mph)	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
F4	Devastating tornado (207-260 mph)	Devastating damage. Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado (261-318 mph)	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur.

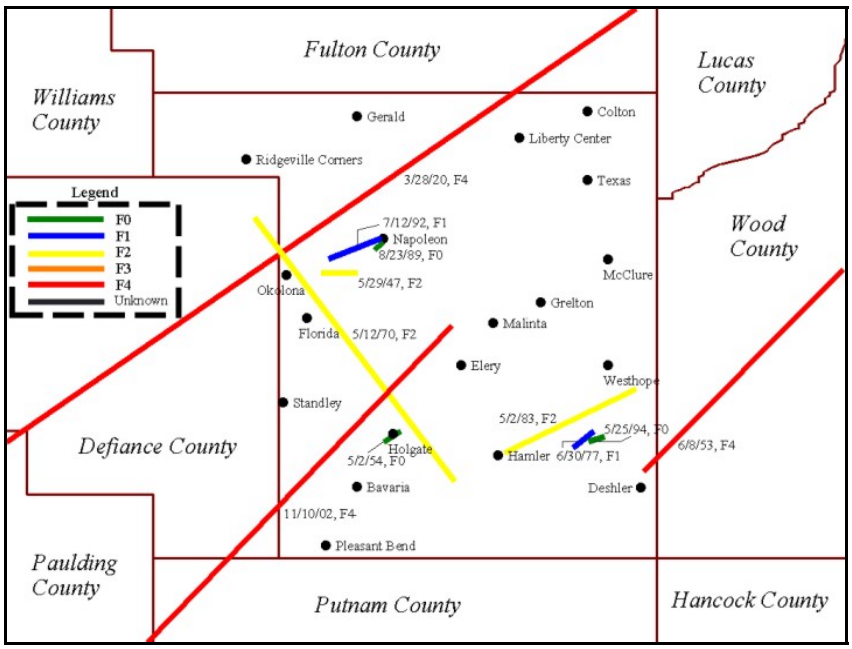
Thunderstorms and hurricanes spawn tornadoes when cold air overrides a layer of warm air, causing the warm air to rise rapidly. The winds produced from hurricanes, earthquake-induced fires, and wildfires have also been known to produce tornadoes. In Henry County, tornadoes are typically spawned from thunderstorms.

To learn information on past tornadoes in Henry County, the Tornado Project web site at www.tornadoproject.com/alltorns/ohtorn2.htm was reviewed. It contained information for tornadoes in Henry County from 1950 to 1995. Also, the National Climatic Data Center (NCDC) website for storm events in Henry County contained information for events from 1950 to 2004. This information, combined with information obtained from books and newspapers at the library, resulted a tabulation of the following information. Appendix B contains more information on these hazard events. The approximate location for these tornadoes is shown in a picture that follows. The information was obtained from the NOAA website.

Bartlow Twp.
1953 Tornado

Henry County Tornadoes

Date	Location	Deaths	Injuries	Damage	F Scale
6/29/1906	Holgate	0	4	Unknown	unknown
5/19/1919	Napoleon	0	0	Unknown	unknown
3/28/1920	Napoleon & Freedom Twps	0	3	$500,000	F4
5/29/1947	Napoleon Twp	unknown	unknown	Unknown	F2
6/8/1953	Bartlow Twp	5	1	Unknown	F4
5/2/1954	Holgate	0	0	Unknown	F0
5/12/1970	Marion, Pleasant, Flatrock & Napoleon Twps	0	0	$25,000	F2
5/1973	Malinta	0	0	Unknown	unknown
6/30/1977	Bartlow Twp	0	0	$3,000	F1
5/2/1983	Marion & Richfield Twps	0	0	$2,500,000	F2
8/23/1989	Napoleon	0	0	$25,000	F0
7/12/1992	Napoleon Twp	0	1	$25,000	F1
5/25/1994	Bartlow Twp	0	0	Unknown	F0
11/11/2002	Pleasant, Flatrock & Monroe Twps	0	0	$10,000	F0
6/13/2004	Pleasant Twp.	0	0	$75,000	F1

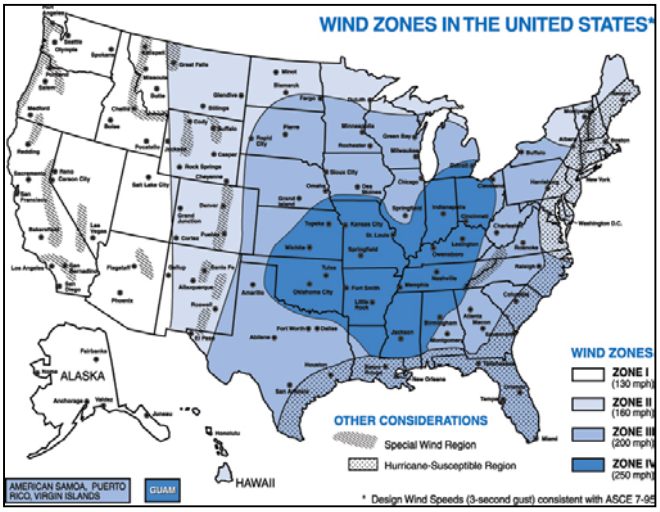


NOAA

Henry County has also been affected by storms with strong winds. Typically associated with thunderstorms, these windstorms have caused property damage and personal injury in the past. The damage is usually associated with downed trees or power poles, broken windows, damaged vehicles and some damage to structures. There have been numerous reports of gusts in excess of 50 mph throughout Henry County.

Wind speeds of 80 mph were reported on November 11, 2002, near Hamler and were responsible for the derailment of a train. This wind was thought to be downburst winds from the collapse of a parent supercell that produced an F0 tornado in Pleasant, Flatrock and Monroe Townships in Henry County and a F4 tornado in Van Wert County, Ohio.

To determine the "Design Wind Speed" for Henry County, the FEMA web site was reviewed. From Publication 320 *Taking Shelter from the Storm: Building a Saferoom in Your House* (see adjacent insert), Henry County is located in Zone IV, which is associated with wind speeds of 250 mph.



2.2.2 Winter Storm/Blizzard

Each year, Henry County receives approximately 37 inches of snow. The snow comes in the form of snow flurries to blizzards. A blizzard is defined as winds of 35 mph or more with snow reducing visibility to less than ¼ mile for at least 3 hours.

For winter storms to form, they need three key components: cold air, moisture and lift. For snow and ice to form, the temperature must be below freezing in the clouds and near the ground. Water evaporating from bodies of water, such as large lakes, is an excellent source of moisture. Lift causes moisture to rise and form clouds and precipitation. An example of lift is warm air colliding with cold air and being forced to rise.

Holgate
1978 Blizzard

January 25, 1978, was the beginning of what has been known as the "Blizzard of '78". The storm began as freezing rain that turned into snow. By the early morning on January 26, 1978, there were six to eight inches of snow on the ground, and the snow was still falling. From January 25 to January 29, over 12 inches of snow fell. Combined with wind gusts up to 45 mph, temperatures of 11 degrees Fahrenheit and snowdrifts 20 feet high, this was a major storm. By noon on January 26, Governor Rhodes declared the state a Civil Defense state of emergency. On January 27, 1978, the state was declared a national disaster area. The southern half of the county was without electricity and heat for over three days. Due to the continued drifting of roads, it took a week to open many of the county roads. US 6 was closed for three days. By January 29, 1978, most roads in the county were open to one lane width. At least one person died in Henry County from the storm.

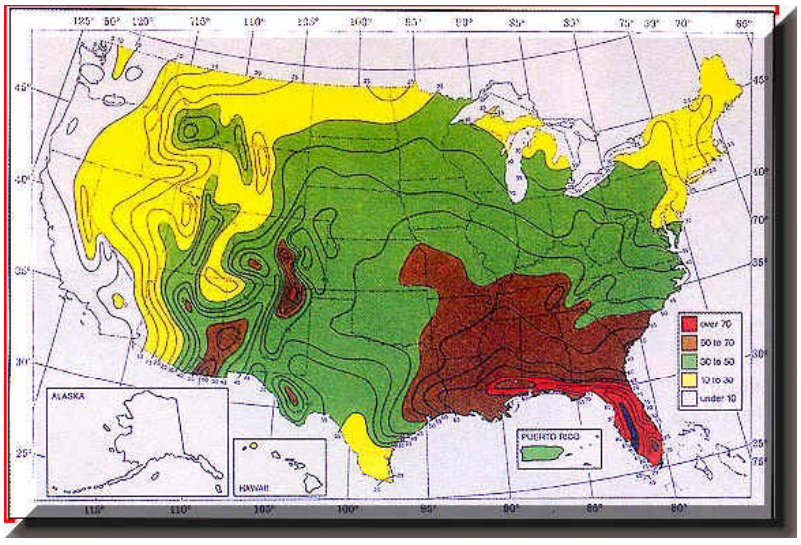
The NCDC website for storm events in Henry County contained information for events from 1950 to 2004. They indicated 20 other events of heavy snow, ice or extreme cold. The information relative to deaths, injuries and damage is for the area impacted, which is typically multiple counties and not limited to just Henry County. Appendix B contains more information on these hazard events.

Winter Storms in Henry County

Date	Type	Deaths	Injuries	Damage
1/25/1978	Blizzard	unknown	unknown	unknown
2/25/1993	Heavy Snow	0	0	$500,000
12/26/1993	Extreme Cold	1	0	$500,000
2/25/1994	Heavy Snow	0	0	$50,000
1/21/1995	Heavy Snow	0	0	$500,000
2/11/1995	Extreme Cold	4	0	$100,000
4/4/1995	Extreme Cold	0	0	$0
4/10/1995	Glaze	0	0	$150,000
12/9/1995	Extreme Cold	0	0	$210,000
12/9/1995	Extreme Cold	0	1	$2,000
12/13/1995	Ice Storm	0	0	$60,000
2/2/1996	Extreme Cold	1	0	$3,400,000
3/19/1996	Heavy Snow	0	0	$352,000
1/10/1997	Extreme Cold	4	0	$195,000
3/13/1997	Ice Storm	0	0	$200,000
1/13/1998	Glaze	0	4	$0
1/2/1999	Heavy Snow	0	0	$0
3/11/2000	Heavy Snow	0	0	$0
12/13/2000	Heavy Snow	0	0	$0
12/25/2002	Heavy Snow	0	0	$0
2/22/2003	Heavy Snow	0	0	$0

2.2.3 Thunderstorm

Thunderstorms can bring heavy rains (which can cause flash flooding), strong winds, hail, lightning, and tornadoes. According to NOAA, Henry County can expect between 30-50 days of thunderstorms per year (see insert).



Thunderstorms affect relatively small areas, when compared with hurricanes and winter storms. Despite their small size, all thunderstorms are dangerous. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Every thunderstorm needs moisture to form clouds and rain, unstable air, as in warm air, that can rise rapidly, and lift in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. Thunderstorms may occur singly, in clusters, or in lines. Thus, it is possible for several thunderstorms to affect one location in the course of a few hours. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time. Of the estimated 100,000 thunderstorms that occur each year in the United States, about 10 percent are classified as severe.

All thunderstorms contain lightning. Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs between the clouds and the ground. A bolt of lightning reaches a temperature approaching 50,000 degrees Fahrenheit in a split second. The rapid heating and cooling of air near the lightning causes thunder.

Hail is formed by strong rising currents or air within the storm, called updrafts, carrying water droplets to a height where freezing occurs. Ice particles grow in size, become too heavy to be supported by the updraft, and fall to the ground. Large stones fall at speeds faster than 100 mph.

The National Weather Service considers a thunderstorm severe if it produces hail at least ¾ inch in diameter, winds of 58 mph or stronger, or a tornado.

Deshler Thunderstorm March 19, 1947

Colwell's Garage after storm March 19, 19[illegible]

In the past, all areas of Henry County have seen numerous thunderstorms. Typically, the damage associated with these storms, when the storms did not cause floods or develop tornadoes, were associated with hail damage, downed trees and power poles, and lightning strikes to structures. The NCDC website for storm events in Henry County contained information for events from 1950 to 2004. They indicated 21 events of hail larger than 0.75 inches. The largest hail event recorded was in Hamler on September 25, 1994. During that event 2-inch hail was reported which caused $500,000 in property damage and $500,000 in crop

damage. During another thunderstorm on May 1, 2003, the local newspaper, *Northwest Signal*, indicated that a barn was struck by lightning and was destroyed. The NCDC website also indicated 67 events of high winds associated with thunderstorms. The damage reported with these storms was typically downed tree limbs and power poles. A thunderstorm with high winds on May 17, 1999 near Ridgeville Corners caused $20,000 in property damage.

Holgate Thunderstorm August 8, 1979

Based on information from other reference material, there were some other thunderstorms in Henry County that caused damage. They include the March 19, 1947 storm that caused a reportedly thousands of dollars damage to Colwell's Garage and the B&O Freight Hose in Deshler. Debris blocked Main Street for 24 hours and the residents of Deshler were without electricity for 26 hours. No lives were lost. Another thunderstorm hit the southern portion of Henry County on August 8, 1979. The storm caused power outages in Holgate and New Bavaria and many trees were downed causing damage in Holgate and Hamler. There were no reported injuries or deaths.

The following tables indicate the thunderstorms that contained hail or high winds. This information was obtained form NCDC's web site and the damage totals are not necessarily limited to just Henry County. Many of these events do not have damage values. This is due to the difficulty of obtaining such information. Appendix B contains more information on these hazard events.

Hail Events in Henry County

Date	Injury	Death	Property Damage	Crop Damage
6/7/1980	0	0	$0	$0
5/2/1983	0	0	$0	$0
3/28/1985	0	0	$0	$0
5/17/1986	0	0	$0	$0
8/26/1986	0	0	$0	$0
6/8/1987	0	0	$0	$0
6/29/1987	0	0	$0	$0
5/9/1988	0	0	$0	$0
8/12/1988	0	0	$0	$0
6/17/1992	0	0	$0	$0
7/20/1992	0	0	$0	$0
9/25/1994	0	0	$500,000	$500,000

Date	Injury	Death	Property Damage	Crop Damage
7/15/1995	0	0	$0	$0
6/27/1998	0	0	$0	$0
8/24/1998	0	0	$0	$0
5/17/1999	0	0	$0	$0
6/9/1999	0	0	$0	$0
5/9/2000	0	0	$0	$0
8/2/2000	0	0	$0	$0
5/25/2002	0	0	$0	$0
8/4/2003	0	0	$0	$0

Thunderstorm Events with High Winds in Henry County

Date	Injury	Death	Property Damage	Crop Damage
3/19/1947	0	0	$1,000's	$0
4/5/1957	0	0	$0	$0
6/30/1977	0	0	$0	$0
8/27/1978	0	0	$0	$0
8/8/1979	0	0	$0	$0
5/30/1980	0	0	$0	$0
6/7/1980	0	0	$0	$0
4/28/1981	0	0	$0	$0
6/8/1981	0	0	$0	$0
6/15/1982	0	0	$0	$0
9/6/1983	0	0	$0	$0
8/14/1985	0	0	$0	$0
5/6/1986	0	0	$0	$0
7/12/1986	0	0	$0	$0
7/25/1986	0	0	$0	$0
8/26/1986	0	0	$0	$0
6/3/1989	0	0	$0	$0
6/22/1989	0	0	$0	$0
8/5/1989	0	0	$0	$0
3/27/1991	0	0	$0	$0
7/29/1991	0	0	$0	$0
5/17/1992	0	0	$0	$0
6/17/1992	0	0	$0	$0
7/14/1992	0	0	$0	$0
7/20/1992	0	0	$0	$0
8/31/1993	0	0	$50,000	$5,000
6/13/1994	0	1	$50,000	$0
6/20/1994	0	0	$0	$0
11/1/1994	0	1	$500,000	$0
11/27/1994	0	1	$50,000	$0

Date	Injury	Death	Property Damage	Crop Damage
11/28/1994	0	0	$500,000	$0
4/11/1995	0	0	$0	$0
6/26/1995	0	0	$2,000	$0
7/13/1995	0	0	$6,000	$0
7/15/1995	0	0	$2,000	$0
8/17/1995	0	0	$0	$0
10/5/1995	0	0	$80,000	$0
10/24/1995	0	0	$25,000	$0
11/11/1995	0	0	$260,000	$0
1/27/1996	0	0	$0	$0
2/10/1996	0	0	$45,000	$0
5/9/1996	0	0	$20,000	$0
7/24/1996	0	0	$0	$0
7/30/1996	0	0	$0	$0
10/30/1996	0	0	$0	$0
2/27/1997	0	0	$180,000	$0
5/18/1997	0	0	$2,000	$0
7/8/1997	0	0	$4,000	$0
3/28/1998	0	0	$1,000	$0
5/31/1998	0	0	$35,000	$0
7/21/1998	0	0	$0	$0
8/24/1998	0	0	$10,000	$0
11/10/1998	0	0	$0	$0
5/17/1999	0	0	$20,000	$0
6/9/1999	0	0	$0	$0
5/9/2000	0	0	$0	$0
8/2/2000	0	0	$0	$0
8/6/2000	0	0	$0	$0
6/12/2001	0	0	$0	$0
3/9/2002	0	0	$0	$0
7/26/2002	0	0	$0	$0
11/10/2002	0	0	$0	$0
4/20/2003	0	0	$5,000	$0
7/6/2003	0	0	$0	$0
7/8/2003	0	0	$0	$0
7/20/2003	0	0	$0	$0
8/26/2003	0	0	$0	$0
11/12/2003	0	0	$0	$0
5/23/2004	0	0	$0	$0

2.2.4 Flood

Floods are natural events for rivers and streams. Excess water from snowmelt or rainfall accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers that are subject to recurring floods.

Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration. A large amount of rainfall over a short period of time can result in flash flood conditions. A small amount of rain can also result in floods in locations where the soil is saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces.

Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover.

Frequency of inundation depends on climate, soil, and channel slope. In regions where substantial precipitation occurs in a particular season each year, or in regions where annual flooding is derived principally from snowmelt, the floodplains may be inundated nearly every year. In regions without extended periods of below-freezing temperatures, floods usually occur in the season of highest precipitation. In areas where flooding is caused by melting snow and occasionally compounded by rainfall, the flood season is spring or early summer.

For Henry County, flooding can and has occurred throughout the year. The Maumee River has gone above flood level in the winter and spring because of snow melt and the breaking up of ice on the river, and also in the summer due to heavy rains. Flooding along creeks in Henry County, such as School Creek and South Turkeyfoot Creek, usually occurs because of heavy rainfall events.

To determine areas that are at risk during floods, the flood insurance rate maps (FIRM) were reviewed. For the unincorporated areas of Henry County, special flood hazard areas (SFHA) are indicated along the Maumee River, Beaver Creek, Owl Creek, Garrett Creek, Van Hyning Creek, Konzen Ditch, North Turkeyfoot Creek, Dry Creek, South Turkeyfoot Creek, Bad Creek, Coon Creek, Big Creek, School Creek, Wade Creek, and Little Turkeyfoot Creek and some unnamed tributaries. The maps for the SFHA along the Maumee River indicate the location of Zone AE, the base floodplain where base flood elevations are provided. A portion of the Maumee River is also designated as a floodway, which is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising the water surface elevation by more than one foot. The maps for the other SFHA indicate Zone A, the base floodplain mapped by approximate methods with base flood elevations not shown.

In Napoleon, the SFHA are indicated along the Maumee River, Oberhaus Creek, Van Hyning Creek and Garrett Creek. The maps for the SFHA along the Maumee River indicate the location of Zone AE, the base floodplain where base flood elevations are provided, and Zone X (shaded), the area between the limits of the 100-year and 500-year floods. A portion of the Maumee River is also designated as a floodway, which is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising the water surface elevation by more than one foot. The maps for the other SFHA indicate Zone A, the base floodplain mapped by approximate methods with base flood elevations not shown.

In Florida, the SFHA is indicated along the Maumee River. The maps for the SFHA along the Maumee River indicate the location of Zone AE, the base floodplain where base flood elevations are provided. A portion of the Maumee River is also designated as a floodway, which is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising the water surface elevation by more than one foot.

In Liberty Center, the SFHA is indicated along Dry Creek. The map for this area indicates Zone A, the base floodplain mapped by approximate methods with base flood elevations not shown.

In Hamler, the SFHA is indicated along South Turkeyfoot Creek. The map for this area indicates Zone A, the base floodplain mapped by approximate methods with base flood elevations not shown.

In Deshler, the SFHA is indicated along Brush Creek. The map for this area indicates Zone A, the base floodplain mapped by approximate methods with base flood elevations not shown. However, Deshler is not in the National Flood Insurance Program.

The Villages of Malinta, McClure and New Bavaria do not have SFHA and are not in the National Flood Insurance Program.

These SFHA are indicated on the Vulnerability Map, located in Appendix A.

In addition to these areas, there is another location in Henry County that is not designated as a special flood hazard area but has a history of flooding and causing damage to the surrounding properties. This area is School Creek in and around Holgate. This area is indicated on the Vulnerability Map in Appendix A and was based on previous floods and the area identified in the May 3, 1974, FIA Flood Hazard Boundary Map for Holgate, Ohio. On May 29, 1979, this area was changed to indicate “No Special Flood Hazard Area”.

The 100-year flood designation applies to the area that has a 1 percent chance, on average, of flooding in any given year. However, a 100-year flood could occur

two years in a row, or once every ten years. The 100-year flood is also referred to as the base flood. The special flood hazard area identified on the FIRM is the 100-year floodplain.

In the City of Napoleon, a gauge is located in the Maumee River. This gauge has measured the height of the river since 1905. During that time, the river has exceeded flood stage at least 19 times. The flood stage is 12.0 feet (636.71 ft NGVD 29). Based on information from the National Weather Service River Forecast Center, the historical crests of the Maumee River in Napoleon are as follows:

25.0 ft on March 27, 1913
19.5 ft on February 11, 1959
19.5 ft on February 14, 1918
19.4 ft on February 28, 1936
18.8 ft on March 2, 1910
18.0 ft on March 20, 1912
17.54 ft on March 15, 1982
17.13 ft on January 1, 1991
16.75 ft on January 25, 1999
16.0 ft on February 16, 1950
15.99 ft on February 26, 1985
14.45 ft on March 15, 2003
13.94 ft on June 16, 1981
13.8 ft on January 6, 1993
13.5 ft on June 3, 1997
13.2 ft on April 14, 1994
13.1 ft on February 21, 1994
13.05 ft on May 11, 2003
12.8 ft on June 15, 2004

Perry Street Bridge
Napoleon
1913 Flood

In Napoleon along the Maumee River, at 12 feet the water will cause flooding of farmland and possibly some secondary roads along the Maumee River. At 15 feet, the floodwaters will threaten some buildings in the east end of Napoleon and cause several roads to be impassable. At 17 feet, massive flooding will occur. Residents in areas adjacent to the Maumee River and its tributaries should prepare for extensive flood losses.

Only four of the flooding events that exceeded flood stage along the Maumee River had reported damage associated with them as indicated in NCDC's web page on storm events. The include: January 6, 1993 with $500,000 in property damage, April 14, 1994 with $50,000 in property damage, June 3, 1997 with $30,000 in property damage and $20,000 in crop damage and January 25, 1999 with $18,000 in property damage.

The flood of 1913 affected the largest area of all of the floods listed in this plan. Not only did this flood have the highest recorded level on the Maumee River in Napoleon, but the villages of Deshler, Florida, Hamler, and Holgate were also affected. Information on the dollar amount of damage done by this flood was not found, but it was noted that at least one person died from the flooding.

Deshler
1913 Flood

Hamler
1913 Flood

In addition to those 19 flooding events on the Maumee River, there were at least two times that bridges on the Maumee River sustained damage due to ice. These include in 1893 when ice destroyed the bridge in Florida and in 1878 when ice destroyed the Perry Street Bridge in Napoleon.

Other flooding events within Henry County that were not associated with the Maumee River include the following.

Florida
1913 Flood

In 1929, Hamler flooded due to rising water of South Turkeyfoot Creek. No information of damage or injuries was found.

On July 15, 1972, Deshler received over 4 ½ inches of rain in less than one hour during the afternoon. This was preceded by 2 inches of rain that morning. All of the rain caused many of the streets in town to flood and basements to be flooded. No information of damage or injuries was found.

On December 30, 1992, the Liberty Center area received 2-inches of rain in a short period of time which resulted in the flooding of Maple Street, Oaks Trailer Court and the railroad underpass on County Road T.

On August 5, 1998, the southern portion of Henry County sustained flooding damage due to heavy rains. As indicated by the NCDC's web page of storm events, $150,000 of property damage and $50,000 of crop damage was reported with no injuries or deaths.

On April 20, 2000, 8 inches of rain fell resulting in flooding in Hamler and Holgate. In Hamler, South Turkeyfoot Creek flooded and caused damage to 63 homes. In Holgate, School Creek flooded and damaged 52 homes, destroying 3 homes.

On March 1, 2001, 3.7 inches of rain fell in 6 hours, and School Creek in Holgate once again flooded and damaged 48 homes.

Appendix B contains more information on these hazard events.

2.3 Community Profile

Henry County is situated in northwest Ohio and consists of 13 townships, 8 villages and 1 city. The County is mainly rural, and most of the land is designated as farmland. Most of the commercial and industrial development in the County is in the City of Napoleon, population 9,318, which is the County's most populated area and is along the Maumee River. The 2000 census indicated a population of 29,210 in Henry County. Based on projections for the Office of Strategic Research, Ohio Department of Development, the population for Henry County in 2005 will be 29,444 and in 2010, the population will be 29,543. Residential growth in Henry County has been slowly increasing. This growth has been mostly in the northern portion of the County in Washington Township, Liberty Township, Freedom Township, the Village of Liberty Center and the City of Napoleon. These trends are expected to continue with the majority of the growth expected in and around existing municipalities. Also, some new facilities that will be constructed within the next year include a new school for the Holgate School District, a new elementary and middle school for the Patrick Henry School District, a lagoon for the Village of Florida and a water tower for the City of Napoleon. New growth in Henry County is expected to be outside the flood hazard area. The unincorporated areas of Henry County, along with the other National Flood Insurance Program (NFIP) communities of Napoleon, Liberty Center, Florida and Hamler, have regulations that require new structures to conform to regulations that are designed to minimize losses due to flood conditions.

The climate in Henry County is mild, with an annual average high temperature of 59 degrees Fahrenheit and an annual average low temperature of 39 degrees Fahrenheit. On average, there are only about 14 days warmer than 90 degrees Fahrenheit and 17 days colder than 5 degrees Fahrenheit. Average precipitation is about 33 inches per year, with 37 inches of snow per year. The average wind speed is around 10 knots.

This plan identifies a number of critical facilities located in the County. These critical facilities are shown on the Vulnerability Map located in Appendix A. A critical facility was defined as one of the following:

- Essential facilities that are essential to the health and welfare of the whole population and are especially important following hazard events. These include hospitals, police stations, fire stations, landfills and schools.
- Transportation systems including airports, bridges, railways and roadways.

- Lifeline utility systems such as water treatment systems, wastewater treatment systems, oil/propane/natural gas facilities, power substations, and communication systems.
- Hazardous material facilities that include fertilizer and farm chemical suppliers.
- Vulnerable populations such as mobile home parks and elderly/handicap care facilities.
- Economic impact facilities such as the Campbell Soup Company and grain elevators.

Based on these criteria, the following critical facilities in Henry County were identified as follows:

- 1 Hospital
- 17 Police and fire stations
- 16 Schools
- 1 Landfill
- 1 Airport
- 5 Bridges over the Maumee River
- 32 locations on roadways that experience high water
- 26 Water and wastewater systems
- 24 Oil/propane/natural gas facilities
- 18 Power substations
- 13 Telephone exchanges
- 29 Telecommunication towers
- 12 Farm service facilities
- 7 Mobile home parks
- 7 Elderly/handicap care facilities
- 15 Grain elevators

Also shown on the Vulnerability Map located in Appendix A are the locations of the 16 warning sirens that are located throughout Henry County, water mains, sewer mains and underground natural gas pipelines that run throughout Henry County.

Due to current Homeland Security issues, the location of critical facilities will remain confidential and will not be made available to the general public. This information will be made available to the review agencies.

The structures that are at risk of flooding are also shown on the Vulnerability Map located in Appendix A. These structures are located in the 100-year floodplain as determined by information received from the Ohio Department of Natural Resources (ODNR) in GIS format. Not specifically highlighted on the Vulnerability Map are the 18 structures that are defined as repetitive loss structures by FEMA. Repetitive loss structures include any currently insured building with two or more flood losses (occurring more than 10 days apart) greater than $1,000 in any 10-year period since 1978.

Of the critical facilities, four have been determined to be in the flood hazard area. One elderly care facility, one telephone exchange, one water tower and a portion of one mobile home park are located within the 100-year flood zone. However, the facilities were constructed on fill material or were elevated such that their lowest floor elevation is above the flood elevation and should not experience any impact from a 100-year flood. Floodwaters do impact roadways in 32 locations in Henry County

For the other hazards, tornadoes, winter storm/blizzards, and thunderstorms, the entire county will be considered the hazard area, since these hazards can occur anywhere in Henry County and all of the critical facilities identified could be impacted by any of these hazards.

Although not located in Henry County, there are two nuclear power plants in close proximity that could impact the county should a natural disaster damage or disable either one of the generating facilities. These nuclear power plants are the Fermi II power plant in Monroe County, Michigan and the Davis Besse plant in Ottawa County. Even though these plants have been designed to withstand the worst weather that could be expected in the area, any potential damage from weather-related natural events is difficult to predict. However, based on the prevailing winds, most of the radioactive material would be carried to the east or northeast, which is away from Henry County.

The following table indicates information regarding existing structures in Henry County and their value. The structures susceptible to floods include the structures in the 100-year floodplain and the structures in the School Creek Flood Area.

Occupancy Class	Total Assets	Flood	Tornado*	Winter Storm / Blizzard*	Thunderstorm*
Residential	10,671	314	10,671	10,671	10,671
Commercial	822	12	822	822	822
Industrial	89	0	89	89	89
Agricultural	1,817	0	1,817	1,817	1,817
Religion / Non-Profit	100	0	100	100	100
Government	109	1	109	109	109
Education	17	0	17	17	17
Number of Buildings	13,625	327	13,625	13,625	13,625
Approximate Value ($M)	956	23.2	956	956	956
Number of People	29,210	410	29,210	29,210	29,210

* These hazards are random in nature and could affect any portion of the county
Source: Henry County Auditor in 2003 Dollars

2.4 Vulnerability Analysis and Loss Estimation

The last part of the Hazard Assessment is to conduct a vulnerability analysis and estimate losses due to future natural hazard events. Based on the guidance document "Understanding Your Risks, Identifying Hazards and Estimating Losses", the information required for this task includes the level of damage from a hazard event in terms of the asset's structural and content replacement value and function. At this time, Henry County does not have that information readily available. Instead, the level of damage from a natural hazard will be determined by historical data.

2.4.1 Tornado

Due to the random nature of tornadoes, the entire area of Henry County is vulnerable to a tornado. Depending of the location of the tornado strike and the strength of the tornado, the damage can vary. Light damage will occur if the tornado strike is in an open area of Henry County where the population is less dense. Greater damage will occur if the tornado strike is in a more densely populated area with many homes and businesses. The effects of future tornadoes and wind storms will fluctuate.

The critical facilities listed in this plan are also vulnerable to tornadoes. Mobile homes are defenseless against high winds and tornadoes. Without basements or shelters, the residents of mobile homes are at great risk to suffer injury or death. Elderly/handicapped care facilities could also sustain heavy losses since they contain a large population with limited mobility. Large populations could also be impacted if services such as water treatment plants, wastewater treatment plants, communication facilities or other utility services are damaged by tornadoes. Emergency services, such as fire, police, EMS and care facilities, could be slowed if their facilities were damaged.

Of the 15 tornadoes that are listed in this plan, only 7 reported damage figures. The information indicated a total of 5 deaths and 5 injuries for those events. Damage caused by past tornadoes has ranged from $3,000 for the June 30, 1977, F1 tornado that struck in Bartlow Township to $2.5 million for the May 2, 1983, F2 tornado that struck in Marion and Richfield Townships. Total damage amounts are $3,088,000. The most deadly tornado was the June 6, 1953, F4 tornado that struck in Bartlow Township and killed 5 people and injured 1.

Based on this information, the expected damage from a tornado is $450,000 of damage with little or no injuries or deaths. However, it is very possible that more damage with injuries and deaths could occur.

2.4.2 Winter Storm/Blizzard

Winter storms and blizzards typically are widespread and affect large areas. The entire area of Henry County can be affected by these storms. The damage caused by these storms can vary depending on the intensity and duration of the storm. Therefore, predicting future damage based on past winter storms is difficult.

The largest impact of these storms is typically on the roadway system. With the accumulation of snow and the blowing and drifting, travel on the roads can be difficult. A lot of time, money and effort is spent on maintaining traffic flow on the roadway systems. When the roadway system becomes impacted, emergency response by fire, police and EMS services are delayed. Also affected are the overhead utility lines. With ice accumulation and wind, these utility lines can break or be broken by falling tree limbs causing the loss of service to its customers. Extended periods without these services, specifically electricity, can lead to serious injury.

The data for the 21 winter storms that were identified in this plan is limited, especially when considering information specifically for Henry County. Typical damage from future winter storms is expected to be low, less than $50,000 with no injuries or deaths. This is less than 1 percent of the value of all the structures in Henry County. However, it is very possible that more damage with injuries and deaths could occur.

2.4.3 Thunderstorm

Thunderstorms can affect any area of Henry County. Every structure is vulnerable to damage caused by lightning, hail, and the high winds that are associated with these storms. The extent of this damage can vary depending on the area affected by the storm and the severity of the storm.

Typically, the damage is associated with broken windows or dented cars due to hail. Hail can also cause damage to crops. The high winds can down tree limbs and cause roof damage. The high winds can also cause disruptions in electrical service if power poles are knocked down or falling tree limbs break the power lines. Depending on the location of the disruption, a large population of people can be without power for a period of time.

The data from the 21 hail events and 69 high wind events from thunderstorms that were identified in this plan is limited. The damaged caused by hail was only available with one of the 21 events. This storm had $500,000 of property damage and $500,000 of crop damage with no injuries or deaths due to 2-inch hail on September 25, 1994 near Hamler. For thunderstorms with high winds, 25 of the 69 events indicated damage, although not always limited to just Henry County. There were 13 events of high wind that did indicate damage specific to Henry County. The total damage caused by these 13 storms was $201,000 in property

damage and $5,000 in crop damage with no deaths and 1 injury. Based on this information, typical damage expected from thunderstorms is $15,000 in property damage with some crop damage and no deaths or injuries.

2.4.4 Flood

Within Henry County, floods can affect 314 residential structures, 12 commercial structures, and 1 government structure. These structures have been determined to be within a special flood hazard area, as identified by all of the FIRMs associated with Henry County, or are within the School Creek Flood Area. These structures have been determined to have a value of approximately $23.2 million, which is 2.4% of the value of all the structures in Henry County.

Of the 327 structures, 18 of these structures have also been labeled as repetitive loss structures by FEMA. Of these structures, 13 are in the unincorporated areas of Henry County, 2 are in Napoleon and 3 are in Holgate. Total payout for structural damage to these repetitive loss structures since 1978 has been $302,004.24. The payout for damage to contents of those same properties has been $141,570.31, yielding a total payout of $443,574.55.

The jurisdictional breakdown of the 327 structures include: 113 structures in the unincorporated area of Henry County, 115 structures (11 commercial) in Napoleon, 20 structures (1 commercial) in Hamler, 1 structure in Liberty Center, 26 structures (1 government) in Deshler, 0 structures in Florida and 52 structures in Holgate (School Creek Flood Area).

The replacement value for these structures has been estimated to be:

Henry County	$7,106,000
Napoleon	$9,564,000
Holgate	$3,414,000
Hamler	$1,199,000
Deshler	$1,866,000
Liberty Center	$ 51,000
Florida	$ 0

However, during a flood event, it is not likely that the entire structure would be damaged. Therefore, to determine the potential loss from a flooding event, some percentage of the replacement value was used. This percentage typically is based on the type of structure and the depth of flooding. Since the type of structures vary throughout Henry County and the depth of flooding is not known for these structures, an assumed value for building damage that represents a typical situation was used. The building damage was determined from *FEMA Benefit-Cost Analysis Full Data Module 3/10/99*, for a one or two story house with basement and a two feet flood depth and the building damage was indicated at 20%

The potential loss for the structures are as follows:

Henry County	$1,421,200
Napoleon	$1,912,800
Holgate	$ 682,800
Hamler	$ 239,800
Deshler	$ 373,200
Liberty Center	$ 10,200
Florida	$ 0

Flood damage can vary depending on a number of factors, such as type of structure, depth and velocity of floodwaters, and others. Not only are there losses to structures, but losses occur to the structure's contents as well. Floods can also affect the roadways. There are 32 locations throughout Henry County that have high water conditions during certain heavy rain events. These high water areas cause the road to be impassable and can delay emergency vehicles.

Of the critical facilities, four have been determined to be in the flood hazard area. One elderly care facility, one telephone exchange, one water tower and a portion of one mobile home park are located within the 100-year flood zone. However, the facilities were constructed on fill material or were elevated such that their lowest floor elevation is above the flood elevation and should not experience any impact from a 100-year flood.

The flood of 1913 affected the largest area of all of the floods listed in this plan. Not only did this flood have the highest recorded level on the Maumee River in Napoleon, but the villages of Deshler, Florida, Hamler, and Holgate were also affected. Information on the dollar amount of damage done by this flood was not found, but it was noted that at least one person died from the flooding.

Another costly flood occurred in Hamler and Holgate in 2000, when 118 houses were affected by flood water. Total damage numbers were not available for this event, but there were no reports of any deaths or injuries.

Of the 27 flooding events listed in this plan, five had damage estimates associated with them. In total, $748,000 in property damage and $70,000 in crop damage occurred with no injuries or deaths. On average, there was $150,000 in property damage and $15,000 in crop damage per flooding event. However, even though not documented, other floods probably did have greater damage associated with them. In the future, depending on the location and severity of the flood, damage could be greater.