

**Coshocton County  
Natural Hazard Mitigation Plan  
2010**

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## **List of Acronyms**

BFE Base flood elevation  
CRS Community Rating System  
DMA Disaster Mitigation Act of 2000  
DOT Department of Transportation  
EMA Emergency management agency  
FEMA Federal Emergency Management Agency  
FIRM Flood insurance rate map  
FMA Flood Mitigation Assistance Program  
GIS Geographic information system  
HMCC Hazard mitigation planning committee  
mph Miles per hour  
N/A (Data) not available  
NCDC National Climatic Data Center  
NFIP National Flood Insurance Program  
ODNR Ohio Department of Natural Resources  
OEMA Ohio Emergency Management Agency  
OEPA Ohio Environmental Protection Agency  
OH Ohio  
PGA Peak ground acceleration  
RL Repetitive (flood) loss  
SARA Superfund Amendments and Reauthorization Act  
US United States (of America)  
USEPA United States Environmental Protection Agency

## Overview

In 2000 FEMA developed the Robert T. Stafford Disaster Relief and Emergency Assistance Act that was later amended by the Disaster Mitigation Act of 2000 (DMA 2000). This document provides legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. The revisions compiled in the DMA 2000 were designed to create more incentives for local governments to coordinate their mitigation actions and implement them.

## Executive Summary

After suffering the effects of floods, tornadoes, winter storms, and other natural and man-made hazards, the citizens, business leaders, and officials of Coshocton County recognized the need to develop a long-term approach to reducing their vulnerability to hazards. In 2009, the Coshocton County hazard Mitigation Core Committee (HMCC), the local leadership for an initiative to promote communities' resistance to natural and human-caused hazards, began a hazard mitigation planning process to identify the hazards that can affect the county and create a strategy to reduce damage from these hazards. The Committee identified the hazards most threatening to the county and then determined a series of prioritized actions necessary to reduce potential damages from these hazards.

This document, the **Coshocton County Hazard Vulnerability Assessment and Mitigation Plan**, represents the work of citizens, elected and appointed government officials, business leaders, and volunteers of non-profit organizations, to develop a plan that will serve as a blueprint for protecting community assets, preserving the economic viability of the community, and saving lives. Endorsed by the Federal Emergency Management Agency (FEMA) and the Ohio Emergency Management Agency (OEMA), the hazard mitigation planning process and the plan will help the county implement its mitigation projects.

The hazard mitigation planning process consisted of:

- Public involvement through a series of meetings;
- Identification of hazards that could affect the county;
- Assessment of the county's vulnerability to these hazards in terms of the number of structures, critical facilities, and people affected;
- Identification of mitigation actions that can reduce the risk from these hazards; and
- Development of an implementation of mitigation actions identifying roles and responsibilities.

No plan can succeed without the support of the community. Because of the diversity of interests in the county and municipalities, the Committee encouraged public input throughout the planning process, allowing citizens a voice in the decisions that will affect their future.

## **Section One: Hazard Vulnerability Assessment**

Describes each hazard's occurrence and effects in the State of Ohio and in Coshocton County and identifies the affect of natural caused hazard events by estimating the exposure of people, buildings, and infrastructure to hazardous conditions. Natural hazards that can affect Coshocton County and deserve detailed study are included in the plan as follows:

- Flooding;
- Tornadoes and Wind Storms; and
- Other Severe Weather.

The follow table summarizes which municipalities are at greatest risk for the various hazards (listed in descending order of vulnerability within each hazard):

**Table 1 Jurisdiction Risk Assessment**

<b>Hazards</b>	<b>Municipalities at Greatest Risk</b>	<b>Basis</b>
Flooding	Coshocton City, Jackson Township, Tuscarawas Township, Lafayette Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.	HAZUS-MH flood model and visual qualitative assessment of floodplain maps
Tornadoes and Wind Storms	Tuscarawas Township, Coshocton City, Village of Warsaw, Franklin Township, and Village of Fresno.	Number of residential and commercial trailers in county parcel database
Winter Storms and other Severe Weather	All municipalities are essentially at equal risk, although weather impacts may vary somewhat according to topography and other factors.	Not applicable

**Section Two: Mitigation Capability Assessment** evaluates the resources that the county goals can access to implement hazard mitigation initiatives.

**Section Three: Mitigation Goals and Objectives** present goals and objectives to guide the hazard mitigation activities.

**Section Four: Mitigation Plan and Implementation Strategy** contains prioritized actions accompanied by details about the responsible organizations, estimated costs, possible funding sources and the timeline for implementation. This section concludes with a discussion of Monitoring, Evaluation and Updating,

which recommends establishing a permanent hazard mitigation team to effectively lead the implementation of the plan and continuation of the hazard mitigation planning process beyond this plan.

## **Introduction**

### **Purpose**

Across the United States, natural disasters have led to increasing levels of deaths, injuries, property damage, and interruption of business and government services. The time, money, and efforts to recover from these disasters exhaust resources, diverting attention from important public programs and private agendas. With several statewide and federal disaster declarations since 1976, the emergency management community, citizens, elected officials, and other stakeholders in Coshocton County, Ohio recognized the impact of disasters on their community and concluded that proactive efforts needed to be taken to reduce the impact of natural hazards.

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

Accordingly, the Coshocton County Hazard Mitigation Core Committee (HMCC), composed of governmental leaders from Coshocton County and federal and State representatives, in cooperation with the elected officials of the county and its municipalities, has sponsored and prepared this Hazard Vulnerability Assessment and Mitigation Plan. The plan is the result of over several year's work by the citizens of the county to develop a pre-disaster multi-hazard mitigation plan that will not only guide the county towards greater disaster resistance, but will also respect the character and needs of the community.

In order to qualify for federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with the Disaster Mitigation Act of 2000 (DMA) and its implementing regulations (44 CFR §§201.6, published February 26, 2002). The Coshocton County Hazard Vulnerability Assessment and Mitigation Plan has been prepared to meet FEMA and OEMA requirements in order for the county to be eligible for funding and technical assistance from state and federal hazard mitigation programs.

### **About Coshocton County**

Coshocton County is located in the east-central portion of Ohio and is bordered by Holmes, Tuscarawas, Guernsey, Muskingum, Licking, and Knox counties. The county seat is Coshocton City. The county covers 564 square miles and has a



population of 36,655 people (2000 Census Bureau data). There are 13,100 buildings in the region, which have an aggregate total replacement value (excluding contents) of \$1,952 million (2002 dollars). Approximately 99 percent of the buildings (and 87 percent of the building value) are associated with residential housing.

## Planning Process

### Coshocton County Hazard Mitigation Planning Committee

The county's Hazard Mitigation Planning Committee (HMCC) currently consists of the following members:

Table 2 Committee Members		
Name	Agency	Status
James Van Horn	County Office of Emergency Management	New
Jordan Seib	County Office of Emergency Management	New
Sue Vance	County Office of Emergency Management	Continued
Andrew Jones	County Engineer's Office	New
Kirby Hasseman	Business Owner	New
Lori Everhart	City Park District	New
John McDonald	Coshocton Campus	New
Steve Lonsinger	County Health Department	Continued
Dean Talbot	Citizen of Coshocton County	New
Debbie Kapp-Salupo	Coshocton County Career Campus	New
Rodney Albertson	Insurance Agent	Discontinued
Andy Arthurs	County Office of Emergency Management	Discontinued
Tom Gray	Army Corps of Engineers, Mohawk Dam	Discontinued
Darlene Guess	Realtor	Discontinued
Fred Wachtel	County Engineer	Discontinued
Greg Nowak	County Memorial Hospital	Discontinued
Paul Scherbel	Attorney	Discontinued

James Van Horn serves as chairman of the committee.

The HMCC members identified as one of the most important priorities, the development of a hazard mitigation plan, to identify the hazards that affect the county, assess the likely damage from those hazards, select actions to address the county's vulnerability to such hazards, and develop an implementation-strategy action plan to implement these measures.

The county HMCC met several times starting in November 2009, with one meeting open to the public. The committee is fully involved in the planning process and their input has been vital to the success of developing a countywide mitigation plan. The HMCC participated in the planning process as follows:

## Public Involvement

The HMCC hosted a series of meetings during 2009 to educate stakeholders about their risks, involve them in identifying issues, and educate them about alternative mitigation actions. These meetings provided opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process. The meetings included:

- Committee meeting: presentation to county staff about the hazard mitigation planning process and the draft hazard identification. Topics included hazard mitigation planning and its benefits, steps in the hazard mitigation planning process, and the hazards identified, along with the associated risks.
- Public meeting: regarding hazard mitigation planning, informing the public of draft hazard vulnerability assessment, along with a draft of goals, objectives, and action items. The meeting also prioritized proposed mitigation actions and implementation strategy. This meeting gave the public an opportunity to provide input for the plan.

The Coshocton County HMCC informed residents about these meetings through various means, which included the *Coshocton Tribune* Newspaper and through the counties website (<http://www.coshoctoncounty.net>). The website provided the existing plan and gave in detail how the plan supports the community. The website also provides information on the plan process, which includes revisions, meetings and surveys. There were no public surveys sent out for the revision of the plan. Coshocton County EMA will hold a meeting presenting the plan to the public and participating jurisdictions.

Some feedback was given from the local community, which included educational information provided for the schools and the County Fair. In addition, individuals inquired about mobile homes receiving weather radios.

Local, State and Federal agencies, local businesses, community leaders, educators, and other relevant private and nonprofit interests groups were given the opportunity to participate in the plan development in the same manner as residents – through newspaper announcements, public meetings, and the county website.

## Multi-Jurisdictional Approach

Coshocton County took a multi-jurisdictional approach to preparing its hazard mitigation plan. The county had resources (e.g., funding, data, GIS, etc.), which local jurisdictions lacked. However, the county could not develop the plan on its own. To undertake such a regional planning effort, the county needed to involve its member municipalities, since only they have the legal authority to enforce

compliance with land use planning and development issues. The county undertook an intensive effort to involve all 28 municipalities (22 townships, 5 villages, and one city) in the planning process. Each jurisdiction was invited to the public planning meetings, along with being contacted in regards to any input they would have for the plan. The formal adoption will be done after the federal approval. The following municipalities have participated in the development of this plan and have each acknowledged the updating of the plan, which includes mitigation action items specific to each jurisdiction:

**Table 3 Municipal Participation Jurisdiction**

<b>Incorporated Areas</b>	<b>Types of Participation</b>	<b>Initial Adoption &amp; Continue Participation</b>
Coshocton City	<p>Each jurisdiction was given multiple opportunities to participate in this process, such as:</p> <ul style="list-style-type: none"> <li>• Invited to the HMCC meetings;</li> <li>• Sent a copy of the draft vulnerability assessment and mitigation actions for comment;</li> <li>• Invited to a meeting to review and prioritize the mitigation actions; and</li> <li>• Given an executive summary of draft plan for review and comment (and provided with the opportunity to review the complete plan).</li> </ul>	8/25/04-1/5/09
Warsaw		9/15/04
West Lafayette		8/9/04 -12/11/09
Village of Plainfield		8/4/05-12/31/09
Village of Nellie		1/29/09
Conesville		9/13/04
Lafayette		12/14/09
Unincorporated Areas (Townships)		
Adams		8/18/09-12/17/09
Bethlehem		8/25/04
Crawford		9/7/04 -12/10/09
Linton		8/9/04- 1/29/10
Newcastle		9/13/04-12/1/09
Perry		9/17/04-12/28/09
Pike		8/3/04
Tiverton		7/28/04-1/10/10
Tuscarawas		9/9/04-12/29/09
Virginia		8/2/04-3/1/10
Washington		9/6/04-12/31/09
Monroe		12/14/09
Franklin		12/13/09
Jackson		12/29/09
Bedford		12/30/09
Oxford		12/30/09
White Eyes		12/31/09
Keene		12/14/09
Jefferson		
Millcreek		1/29/10
Clark		2/24/10

Majority of the jurisdictions in Coshocton County accepted the letter of notification that the plan was being constructed and that the EMA office was looking for any additional input. This was done by a letter found in Appendix E. Some Jurisdictions submitted input for specific consideration of mitigation

actions. Other parts of the plan were reviewed and information remains current and called. Therefore, no change was necessary. The jurisdictions that provided some information to the EMA office included Tiverton, Conesville and the Village of Plainfield.

Tiverton inquired about providing weather radios for each of the mobile homes and looking into analyzing the cost of putting a dome shelter into the area of the mobile homes. Conesville and the Village of Plainfield called in order to receive a copy of the plan. They were informed that they would receive a copy once the plan had been completed.

## Regulatory Compliance

The planning process and the plan itself allow Coshocton County and its participating municipalities to establish a foundation for future mitigation activities, capitalize upon implementation resources and opportunities, and implement life-and property-saving mitigation measures.

The plan components address the local hazard mitigation planning requirements of the Disaster Mitigation Act of 2000. The following cross-reference indicates what sections of the plan address specific requirements in the Interim Final Rule, the regulation implementing DMA 2000.

**Table 4 FEMA Plan Review Criteria and Corresponding Coshocton County Plan Sections FEMA Review Criteria**

<b>FEMA Review Criteria</b>	<b>Coshocton County Hazard Vulnerability Assessment and Mitigation Plan</b>
<b><i>Prerequisite</i></b> <ul style="list-style-type: none"> <li>Adoption by the Local Governing Body (§201.6(c)(5))</li> </ul>	<ul style="list-style-type: none"> <li>NA (applies to single jurisdiction)</li> </ul>
<ul style="list-style-type: none"> <li>Multi-jurisdiction Plan Adoption (§201.6(c)(5))</li> <li>Multi-jurisdictional Participation (§201.6(a)(3))</li> </ul>	<ul style="list-style-type: none"> <li>Resolutions of Adoption</li> <li>Introduction</li> </ul>
<b><i>Planning Process</i></b> <ul style="list-style-type: none"> <li>Documentation of Planning Process (§201.6(c)(1))</li> </ul>	<ul style="list-style-type: none"> <li>Introduction</li> </ul>
<b><i>Risk Assessment</i></b> <ul style="list-style-type: none"> <li>Identifying Hazards (§201.6(c)(2)(i))</li> <li>Profiling Hazard Events (§201.6(c)(2)(i))</li> <li>Assessing Vulnerability: Identifying Assets (§201.6(c)(2)(ii)(A))</li> <li>Assessing Vulnerability: Estimating</li> </ul>	<ul style="list-style-type: none"> <li>Section One: Hazard Identification and Vulnerability Assessment</li> </ul>

Potential Losses, <sup>1</sup> (§201.6(c)(2)(ii)(b)) <ul style="list-style-type: none"> <li>Assessing Vulnerability: Analyzing Development Trends (§201.6(c)(2)(ii)(c))</li> <li>Multi-jurisdictional Risk Assessment (§201.6)(c)(2)(iii))</li> </ul>	
<b>Mitigation Strategy</b> <ul style="list-style-type: none"> <li>Local Hazard Mitigation Goals (§201.6(c)(3)(i))</li> <li>Identification and Analysis of Mitigation Measures (§201.6(c)(3)(ii))</li> <li>Implementation of Mitigation Measures (§201.6(c)(3)(iii))</li> <li>Multi-jurisdictional Mitigation Strategy (§201.6(c)(3)(iv))</li> </ul>	<ul style="list-style-type: none"> <li>Section Two: Mitigation Goals and Objectives</li> <li>Section Three: Alternative Mitigation Actions</li> <li>Section Four: Mitigation Plan and Implementation Strategy</li> <li>Section Four: Mitigation Plan and Implementation of Mitigation Actions</li> </ul>
<b>Plan Maintenance Procedures</b> <ul style="list-style-type: none"> <li>Monitoring, Evaluating, and Updating the Plan (§201.6(c)(4)(i))</li> <li>Implementation Through Existing Programs (§201.6(c)(4)(ii))</li> <li>Continued Public Involvement (§201.6(c)(4)(iii))</li> </ul>	<ul style="list-style-type: none"> <li>Section Four: Mitigation Plan and Implementation of Mitigation Actions</li> </ul>

<sup>1</sup> Criteria highlighted in gray are not required by the DMA 2000 Interim Final Rule; however, FEMA highly encourages communities to address such criteria in the plan. Detailed loss estimation is not included in this plan due to data limitations. Receiving a less than satisfactory score on such elements will not prevent the plan from being approved.

## Section One: Hazard Identification and Profiles

Section One identifies the hazards that may affect Coshocton County and defines the hazards in terms of their previous events, likelihood of occurrence, physical characteristics, and the potential severity of such an occurrence.

Hazard identification involves investigating the existence of certain types of natural conditions in and around the county to reveal the hazards that may affect it. Features like topology, soil and rock types, hydrology, and seismology not only determine which hazards the county will experience, but also determine the impact of hazards on people, structures, and infrastructure. The incidence of a past hazard event in the county is a good determinant of future possible incidence. Consequently, hazard identification first determines whether the hazard has occurred previously. Next, a hazard profile is developed to determine the frequency or probability of future events, and the characteristics of the hazard as it occurs in the county, including its severity and factors in the county that may exacerbate the severity.

The vulnerability assessment identifies the effects of a natural hazard event by estimating the exposure of people, buildings, and infrastructure to hazardous

conditions. The assessment allows the county and its municipalities to focus attention to areas most likely to be damaged or most likely to require early response activity during a hazard event, helping to set mitigation priorities. Depending upon the data available, a vulnerability analysis involves counting the number of structures or people in the path of hazards or describing what these hazards can do to physical, social, and economic assets. The vulnerabilities identified in this section consist of an inventory of affected structures completed primarily using GIS software to identify the hazard areas and FEMA's HAZUS-MH to model flood impacts. This assessment does not address future infrastructures or buildings that may be built in the future. The County's Comprehensive Land Use Plan addresses these issues. However, the plan was constructed four years ago and is not current with the county's economic position. With the economic trend on Coshocton County, there is no real consistent growth developing in the community. Any new construction that is built will have to go through building regulations, which include land and zoning ordinances and will be in coordination with the county's Comprehensive Land Use Plan.

Estimating losses in hazard events requires a full range of information and accurate data. There are a number of site-specific characteristics that determine a structure's ability to withstand hazards like first-floor elevation, the number of stories, construction type, foundation type, and the age and condition of the structure. The county maintains a property tax assessment database that includes some of this information, but this information was not completely accessible at the time that this report was prepared.

Each hazard is discussed in terms of its potential impact on the community; including the types of structures and infrastructure that may be damaged or cause further harm.

**Table 5 Summary of Hazard Identification**

<b>Hazard</b>	<b>Why Identified</b>	<b>Source of Information</b>	<b>Disposition</b>
Floods	Past disaster events in the county	FIRMs and digital Q3 data, past disaster declarations	Profile and vulnerability assessment
Severe weather (i.e., tornadoes, winter storms)	Frequent occurrences in the county	Input of HMCC, past disaster declarations, NCDC data	Profile and vulnerability assessment
Subsidence	Past occurrences in the state	Input of HMCC, USGS data	Described and considered low risk, therefore not profiled

Wildfires	Past occurrences in the state	Input of HMCC, DCNR data	Described and considered low risk, therefore not profiled
Earthquake	Past occurrences in the state	Input of HMCC, USGS data	Described and considered low risk, therefore not profiled
Class One Dams	Multiple Dams located throughout the county and help to control and support the water.	Input of HMCC, USGS data, Army Corp of Engineers	Described and considered low risk of failure but structures that need consistent up keeping.

Those natural hazards that are likely to affect Coshocton County considerably are profiled and corresponding vulnerabilities assessed in the following section. These hazards are as follows:

- Flooding;
- Tornadoes and Wind Storms; and
- Other Severe Weather.

Other hazards that have little potential to occur are described but were not profiled, and the vulnerability to these hazards was not assessed.

## 1.0 Hazard Vulnerability Assessment

### Floods

#### Overview – Floods

A flood is a natural event for rivers and streams. For inland areas like Mideastern Ohio, excess water from snowmelt or rainfall accumulates and overflows onto the stream banks and adjacent floodplains. As illustrated in Figure 1, floodplains are lowlands, adjacent to rivers, streams and creeks that are subject to recurring floods.

#### Figure 1 Floodplain Terminology

Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories. In Ohio, flooding occurs commonly and can occur during any season of the year from a variety of sources. Every two to three years, serious flooding occurs along one or more of

Ohio's major rivers or streams, and it is not unusual for this to occur several years in succession. Most injuries and deaths from flooding happen when people are swept away by flood currents and most property damage results from inundation by sediment-filled water.

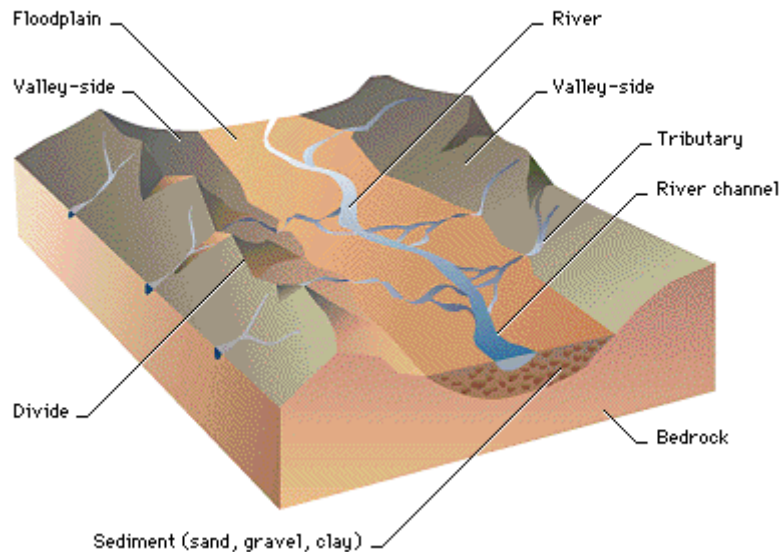


Figure 1

Several factors determine the severity of floods, including rainfall intensity and duration, topography and ground cover. A large amount of rainfall over a short time span can result in flash flood conditions. A small amount of rain can also result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

### Previous Occurrences – Floods

Coshocton County has a long history of flooding problems. The City of Coshocton is situated at the confluence of the Tuscarawas and Walhonding Rivers, which merge to form the Muskingum River. Coshocton County has suffered damage from numerous major floods and localized flash flooding. At least five times in the last half of the 19<sup>th</sup> century, the Muskingum River basin was severely flooded. A flood in 1913 caused an estimated 14 million in damage, which led to the implementation of major flood control projects in the 1930s.

Table 6 lists some of the significant flood events in Coshocton County over more than 40 years.

### Table 6 History of Flooding in Coshocton County



Location	Date	Death	Injury	Property Damage, \$K	Crop Damage, \$K <sup>3</sup>
Several counties	3/24/64	N/A	N/A <sup>5</sup>	571	NA
Several counties	7/15/69	N/A	N/A	1,000	NA
Several counties	6/10/89	N/A	N/A	2,900	NA
Countywide	1/15/1995	0	0	30	0
Warsaw	1/18/1996	0	0	50	0
Warsaw	1/23/1997	0	0	5	0
Countywide	5/2/1998	0	0	10	0
Several counties	6/27/1998	0	0	5,000	10,000
Several counties	4/14/2002	0	0	10	0
Countywide	4/19/2002	0	0	5	0
Mound	5/30/2002	0	0	100	0
Warsaw	8/27/2003	0	0	50	0
County Wide	2005	0	0	2,150,000	0

“Countywide” means several locations in the county; “several counties” means Coshocton and other neighboring counties.

NCDC damage cost data assumed to be as reported at the time; values were adjusted by the CPI.

No data available from NCDC, but Ohio EMA indicates disaster declaration.

(Data) not available Disaster Declaration

## Hazard Characteristics

In Mideastern Ohio, including Coshocton County, there are seasonal differences in the causes for floods. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds, although the snowpack is generally moderate during most winters. Winter floods also have resulted from runoff of intense rainfall on frozen ground, and local flooding has been exacerbated by ice jams in rivers, streams and creeks.

Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms that deposited large quantities of rainfall over a short period of time have also produced flash flooding.

The flooding in this region has been associated with the Muskingum River Basin. Figure 2 (included in this section and at the back of this report) indicates the location of these water courses.

## Probability of Occurrence

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of

occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year.

A specific flood that is used for a number of purposes is called the “base flood”, which has a one percent chance of occurring in any particular year. The base flood is often referred to as the “100-year flood” since its probability of occurrence suggests it should reoccur once every 100 years, although this is not the case in practice. Experiencing a 100-year flood does not mean a similar flood cannot happen for the next 99 years; rather it reflects the probability that over a long period of time, a flood of that magnitude has a one percent chance of occurring in any give year.

Smaller floods occur more often than larger (deeper and more widespread) floods. Thus, a “10-year” flood has a greater likelihood of occurring than a “100-year” flood. Table 7 shows a range of flood recurrence intervals and their probabilities of occurrence.

The extent of flooding associated with a one percent probability of occurrence – the base flood – is used as a regulatory boundary by a number of federal, state and local agencies. Also referred to as the “special flood hazard area” (see Figure 1), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities, since many communities like Coshocton County have maps available that show the extent of the base flood and the likely depths that will be experienced. Figure 2 depicts the base flood area (100-year floodplain) in Coshocton County.

**Table 7 Flood Probability Terms**

<b>Flood Recurrence Intervals</b>	<b>Chance of Occurrence in any given year, %</b>
10 year	10
50 year	2
100 year	1
500 year	0.2

Source: FEMA 386-2, Understanding Your Risks

## **Severity**

Several factors determine the extent or “severity” of floods, including rainfall intensity and duration or volume and rate of snowmelt. The county also has conditions that may exacerbate the effects of floods:

- Topography and ground cover contribute to the location and severity of floods, e.g., water runoff is greater in areas with steep slopes and little or no vegetative ground cover.

- Steep slopes: the county has sloping terrain that can contribute to increased flooding, since runoff reaches the receiving creeks, streams and rivers more rapidly over steeper terrain.
- Paved surfaces: urbanization leads to replacement of vegetative ground cover with asphalt and concrete, increasing surface runoff of storm water. This effect may be exacerbated by poorly planned storm water drainage systems.
- Hazardous materials facilities: Facilities that handle or store hazardous materials may be located in the 100-year and 500-year floodplains, presenting potential sources of contamination during flood events.

## **Hazard Vulnerability – Floods**

### **Existing Community Assets**

The flood hazard vulnerability assessment for the county focused on the community assets that are located in the 100-year floodplain. While greater and smaller floods are possible, information about the extent and depth for the 100-year floodplain is available in a similar format for all Coshocton County municipalities, providing a consistent basis for analysis.

FEMA's HAZUS-MH software was used to assess flood vulnerability in the 100-year floodplain for Coshocton County. The HAZUS-MH model lists 205 stream reaches that are in the county; due to modeling constraints, only a portion of these could be modeled at a time as a "study case". The various reaches were broken into 36 study cases for modeling runs, due to problems with the initial release of the model (this was reportedly alleviated in a later release/patch for the model). These 36 study cases encompassed all of the stream reaches in the county. These studies have not been updated since the initial acceptance of the plan, due to compatibility of computer programs. Coshocton County EMA office is currently working with the planning commission office and the floodplain manager to update these case studies, but still finds the past reports necessary to include.

The HAZUS-MH software uses floodplain data from FEMA's flood insurance rate maps (FIRMs), along with digital topographic information, and hydrologic data from stream flow to determine the base flood elevation (BFE) for the 100-year floodplain and the associated depth of flooding for structures in the county. All but five of the study cases in the Level 1 Assessment indicated no economic loss from the 100-year flood. The losses from these five study cases are indicated in Table 8. The summary reports from these five cases are presented in Appendix B.

**Table 8 Results of HAZUS-MH**

<b>Flood Model Study Case</b>	<b>Building-Related Economic Loss Estimate, \$K</b>
4	58.2
6	175.8
11	7.7
0319b	14.1
A	298.5
<b>Total</b>	<b>554.3</b>

Source: FEMA's HAZUS-MH Flood Model (Build 30B)

Although HAZUS-MH does not list the municipalities that are at risk from flooding, a qualitative visual analysis of the flood plain maps and the HAZUS-MH results in Appendix B indicates that the municipalities at the greatest risk from flooding (in order of approximate decreasing relative vulnerability) appear to be:

- City of Coshocton
- Jackson Township,
- Tuscarawas Township,
- Lafayette Township,
- Jefferson Township (including Nellie and Warsaw Villages),
- Bethlehem Township,
- Conesville,
- Franklin Township, and
- Newcastle Township.

Repetitive-Loss (RL) properties under the National Flood Insurance Program (NFIP) guidelines include any building insured under the NFIP<sup>7</sup> with two or more flood losses (occurring more than ten days apart) greater than \$1,000 in any 10-year period since 1978. FEMA maintains a national list of such properties, and there is two RL properties in Coshocton. FEMA has specifically targeted certain RL properties (i.e., those with the greatest number of claims).

Each of these single family structures made two claims. The first structure made a total in claims amounting to \$200K in 2004 and 2005. The second structure made a total in claims amounting to \$56K in 1994 and 1999. The EMA office went out to assess each of these and found that there is no longer a structure on both of the properties. Through further review, at this time, it is unknown weather these properties were acquisitioned or not.

### **Critical facilities**

HAZUS-MH identified three critical facilities in Coshocton County that would be damaged and suffer some loss of use from the 100-year flood. As noted previously, HAZUS-MH does not list which municipalities the critical facilities are in;

## **Future Development Trends**

New structures in flood-prone areas would be developed per current floodplain-management ordinances.

## **Conclusions – Floods**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

## **Summary of Hazard Vulnerability Assessment**

Floods have been, and will continue to be a significant threat to the economic and social well-being of selected areas of the county. The main sources of flooding in the county, the Muskingum River and its tributaries, have produced significant flooding several times in the past with great consequences for the county. The county has had four declared disasters since 1964.

With an estimated \$55 million in losses from the 100-year flood, flooding is one of the most significant hazards facing Coshocton County. The municipalities at the greatest risk from flooding (in order of approximate decreasing relative vulnerability) appear to be:

- City of Coshocton
- Jackson Township,
- Tuscarawas Township,
- Lafayette Township,
- Jefferson Township (including Nellie and Warsaw Villages),
- Bethlehem Township,
- Franklin Township, and
- Newcastle Township.

## **What can be Mitigated?**

Determining the aspects of Coshocton County flood vulnerability that can be mitigated requires a review of the causal factors for floods. In Coshocton County, flooding is primarily caused by human infringement upon natural processes – simply stated, development has been pursued in naturally occurring floodplains. As a result, available alternatives for mitigation actions (discussed in Section Two – Mitigation Actions) focus on property protection measures, as opposed to altering water courses or changing land management practices within the contributing watersheds. Future development in floodplains will be limited through appropriate legislative and administrative actions and procedures.

## Tornadoe Overview

Like other Midwest communities, Coshocton County experiences many significant severe weather events every year. Depending upon the time of year, amount of atmospheric moisture, wind conditions, and global or regional phenomena like “El Nino”, local weather conditions can turn from routine to hazardous. Severe weather conditions, such as high winds or extremes in snow depths, as well as the ability of businesses or the local government to function. In this portion of Section One, three different types of severe weather are discussed:

- Tornadoes,
- Wind Storms, and
- Winter Storms

## Tornadoes

### Overview – Tornadoes

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

The Fujita Tornado Scale (or the “F-Scale”) classifies U.S. tornadoes into six intensity categories, named F0 to F5, based upon the estimated maximum winds occurring within the funnel. The F-Scale has subsequently become the definitive metric for estimating wind speeds within tornadoes based upon the damage done to buildings and structures.

### Previous Occurrences – Tornadoes

Tornadoes have occurred in Ohio in all seasons and in all parts of the state, but the western portions have been more frequently struck. Table 9 identifies reported tornadoes, respectively, in Coshocton County over half a century.

Table 9 History of Tornadoes in Coshocton County					
Location	Date	F-Scale	Death	Injury	Property Damage, \$K
Newcomerstown	3/11/58	N/A	0	0	200
Countywide	5/9/1961	F1	0	0	3
Countywide	9/26/1970	F2	0	0	3
Countywide	6/30/1977	F1	0	0	25

Several counties	5/31/1985	F3	0	0	25,000
Several counties	5/31/1985	F1	0	0	2,500

Property Damage, Location Date F-Scale Death Injury \$K					
Pike	5/31/85	N/A	0	0	325
Coshocton	4/29/1996	N/A	0	0	0
West Lafayette	5/29/1998	N/A	0	0	0
Several counties	11/10/2002	N/A	0	0	10

Funnel cloud sighted

Ohio EMA indicates disaster declaration on this date for tornadoes, but NCDC lists as high winds only for Coshocton County.

## Hazard Profile – Tornadoes

### Hazard Characteristics

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

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

### Probability of Occurrence/Severity

According to the National Weather Service, the State of Ohio has an annual average of ten tornadoes with two related deaths. The probability of actually being in the path of a tornado in any given year in Coshocton County is quite small, on the order of 0.03 percent (based on probability modeling done for nearby counties). Another way of visualizing this number is that you would have to stand on the same spot for about 3,000 years, to be reasonably certain of being in the direct path of a tornado.

According to the National Weather Service, the State of Ohio has 1 to 5 recorded tornadoes per 1,000 square miles (see Figure 2). The probability of actually being in the path of a tornado in any given year in Coshocton County is quite small; however, the damage that results when the tornado arrives is devastating. A tornado with an “F4” designation can carry a wind velocity of 200 mph resulting in a force of more than 100 pounds per square foot of surface area, a “wind load” that exceeds the design limits of most buildings. An F3 tornado hit portions of Coshocton County in 1985.

## **Hazard Vulnerability – Tornadoes**

### **Existing Community Assets**

Since high winds events may affect the entire county, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Evaluation criteria include age of the building (and what building codes may have been in effect at the time), type of construction, and condition of the structure (i.e., how well has the structure been maintained). Individual structure data was not available for this study, so it was difficult to determine the exact number and types of structures within Coshocton County that have heightened vulnerability to wind hazards. However, mobile homes and commercial trailers are extremely vulnerable to high winds, and Table 10 presents a list by municipality of those structures (in descending order). Therefore, for the purposes of this plan, the vulnerability of county assets to high winds and tornadoes are considered at the same time and are primarily based on the information contained in Figures 3 and 4 and Table 10.

**Table 10. Residential and Commercial Trailers by Municipality**

<b>Location</b>	<b>No.</b>
Tuscarawas Township	135
Coshocton	131
Warsaw	121
Franklin Township	107
Fresno	104
Virginia Township	87
Washington Township	84
Bedford Township	82
West Lafayette	80
Linton Township	79
Lafayette Township	78
Jackson Township	72
Keene Township	68



Oxford Township	65
Perry Township	57
Newcastle Township	53
Pike Township	51
Tiverton Township	47
White Eyes Township	47
Village of Warsaw	45
Newcomerstown	43
Monroe Township	24
Crawford Township	21
Jefferson Township	17
Adams Township	16
Walhonding	13
Millersburg	12
Baltic	11
Bethlehem Township	11
Conesville	9
Killbuck	9
Clark Township	8
Millcreek Township	5
Blissfield	3
Canal Lewisville	2
Village of Nellie	2
Kimbolton	1
Lafayette	1
Village of Conesville	1
Total	1,802

Based on the criteria noted above, the municipalities at the greatest risk from high winds and tornadoes (in order of decreasing relative vulnerability) are:

- Tuscarawas Township,
- City of Coshocton,
- Village of Warsaw,
- Franklin Township, and
- Village of Fresno.

### **Future Development**

The Capability Assessment portion located at the end of this section identifies communities that do not, as yet, have an adopted building code. The lack of codes and/or inadequate inspection capabilities can hinder the ability of new construction to resist design wind load.

### **Conclusion – Tornadoes**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

## Summary of Hazard Vulnerability Assessment

Tornadoes have been and will continue to be a significant threat to the economic and social well-being of areas of the county. Educating residents on possible safe areas and when a tornado is most likely to affect is the key element into mitigation against tornadoes.

## Wind Storms

### Overview – Wind Storms

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

### Previous Occurrences – Wind Storms

Wind Storms have occurred in Ohio in all seasons and in all parts of the state, but have been more frequently struck during hurricane season. Table identifies reported high winds, respectively, in Coshocton County over half a century.

<b>Table 11. History of High Winds in Coshocton County</b>				
<b>Location</b>	<b>Date</b>	<b>Death</b>	<b>Injury</b>	<b>Property Damage, \$K</b>
Several counties	11/28/1994	0	0	500
Coshocton	8/24/1998	0	0	15
Several counties	2/25/2001	0	0	50
New Castle	8/9/2001	0	0	10
Countywide	3/9/2002	0	0	10
Several counties	3/9/2002	0	0	110
Mound	7/19/2002	0	0	15
Several counties	11/10/2002	0	0	10
West Bedford	7/7/2003	0	0	50
Countywide	9/14/2008	0	0	250

Ohio EMA indicates disaster declaration on this date for tornadoes, but NCDL lists only high winds and 2.5 inches of hail for this day.

## Hazard Profile – Winds Storms

### Hazard Characteristics

A Wind Storm can occur at any point in time but tends to occur more often during hurricane season and when high pressure winds move to a low pressure.

Wind Storms are also classified as sustainable lasting winds for an unpredicted amount of time.

### Probability of Occurrence/Severity

The straight-line wind speeds with the greatest probabilities of occurrence, 45 to 77 mph and 78 to 118 mph, correspond to tropical storm/hurricane categories one and two. The expected damages of storms of this magnitude can be determined by using the Saffir-Simpson scale as shown in Table 12.

The expected damages from the wind speeds most likely to be encountered in Coshocton County are considered under this scale to be “minimal” to “moderate”. However, these events can still topple trees and cause severe damage to manufactured homes.

A useful tool for determining vulnerability to the winds that result from hazard events like wind storms is depicted in Figure 3. This map of design winds speeds was developed by the American Society of Civil Engineers and identifies wind speeds that are likely enough to occur in different parts of the United States to be used as the basis for design and evaluation of the structural integrity of community shelters and critical facilities. Figure 3 shows that wind speed zone IV covers the State of Ohio, with design wind speeds of 250 miles per hour.

Note that all townships and villages in the County are essentially at equal risk from wind storms, although weather impacts may vary somewhat over the County, due to topography and other factors.

**Table 12 Saffir-Simpson Scale for Wind Speeds**

Category	Wind Speed	Expected Damage
1	74-95 mph	<b>Minimal:</b> Damage is done primarily to shrubbery and trees, unanchored mobile homes are damaged, some signs are damaged, no real damage is done to structures.
2	96-110 mph	<b>Moderate:</b> Some trees are toppled, some

		roof coverings are damaged, and major damage is done to mobile homes.
3	111-130 mph	<b>Extensive:</b> Large trees are toppled, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131-155 mph	<b>Extreme:</b> Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail; some curtain walls fail.
5	>155 mph	<b>Catastrophic:</b> Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.

Source: National Climatic Data Center website ([www.nhc.noaa.gov/aboutsshs.shtml](http://www.nhc.noaa.gov/aboutsshs.shtml))

## Hazard Vulnerability – Wind Storms

### Existing Community Assets

Since high wind events may affect the entire county, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Evaluation criteria include age of the building (and what building codes may have been in effect at the time), type of construction, and condition of the structure (i.e., how well has the structure been maintained). Individual structure data was not available for this study, so it was difficult to determine the exact number and types of structures within Coshocton County that have heightened vulnerability to wind hazards. However, mobile homes and commercial trailers are extremely vulnerable to high winds, and Table 13 presents a list by municipality of those structures (in descending order). Therefore, for the purposes of this plan, the vulnerability of county assets to high winds are considered at the same time and are primarily based on the information contained in Figures 3 and 4 and Table 13.

**Table 13. Residential and Commercial Trailers by Municipality**

Location	No.
Tuscarawas Township	135
Coshocton	131
Warsaw	121
Franklin Township	107
Fresno	104
Virginia Township	87

Washington Township	84
Bedford Township	82
West Lafayette	80
Linton Township	79
Lafayette Township	78
Jackson Township	72
Keene Township	68
Oxford Township	65
Perry Township	57
Newcastle Township	53
Pike Township	51
Tiverton Township	47
White Eyes Township	47
Village of Warsaw	45
Newcomerstown	43
Monroe Township	24
Crawford Township	21
Jefferson Township	17
Adams Township	16
Walhonding	13
Millersburg	12
Baltic	11
Bethlehem Township	11
Conesville	9
Killbuck	9
Clark Township	8
Millcreek Township	5
Blissfield	3
Canal Lewisville	2
Village of Nellie	2
Kimbolton	1
Lafayette	1
Village of Conesville	1
Total	1,802

Based on the criteria noted above, the municipalities at the greatest risk from high winds (in order of decreasing relative vulnerability) are:

- Tuscarawas Township,
- City of Coshocton,
- Village of Warsaw,
- Franklin Township, and
- Village of Fresno.

## **Future Development**

The Capability Assessment portion located at the end of this section identifies communities that do not, as yet, have an adopted building code. The lack of codes and/or inadequate inspection capabilities can hinder the ability of new construction to resist design wind load.

## **Conclusion – Wind Storms**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

## **Summary of Hazard Vulnerability Assessment**

Wind Storms have been and will continue to be a significant threat to the economic and social well-being of areas of Coshocton County.

## **Winter Storms**

### **Overview – Winter Storms**

A winter storm is an event in which the dominant varieties of precipitation are forms that only occur at cold temperatures, such as snow, sleet, or freezing rain where temperatures are cold enough to allow ice to form on the ground or trees. In temperate continental climates, these storms are not necessarily restricted to the winter season, but may occur in the late autumn and early spring as well. In many locations in the Northern Hemisphere, the most powerful winter storms usually occur in March and, in regions where temperatures are cold enough, April.

Winter storms consist of cold temperatures and heavy snow or ice. Because winter storms are regular, annual occurrences in Ohio, they are considered hazards only when they result in damage to specific structures and/or overwhelm local capabilities to handle disruptions to traffic, communications and electric power.

### **Previous Occurrences – Winter Storms**

The State of Ohio has a long history of severe winter weather. In March 2009, the state was hit by a severe winter storm. The severity and nature of the storm posed a threat to the lives, safety and well-being of state residents and caused major disruptions to the activities of schools and businesses. Problems identified in Ohio during past winter storms include:

- Inability to get roads open in a timely manner;
- Getting non-emergency personnel to stay off of roads;
- People with no heat, people with medical needs, and people who could not obtain necessities;
- Evacuation of mobile homes due to lack of power;
- Inability of farmers to feed and water their livestock; and
- The need to open shelters and lack of good shelter (i.e., places with generators).

**Table 14 History of Winter Storms in Coshocton County**

Location	Date	Type	Death	Injury	Property Damage, \$K
Several <sup>12</sup> counties	1/26/78	Blizzard	N/A	N/A	N/A
Several counties	12/26/1993	Extreme Cold	1	0	500
Several counties	3/9/1994	Ice Storm	0	14	5,000
Several counties	2/3/1995	Heavy Snow	0	0	60
Several counties	2/11/1995	Extreme Cold	4	0	100
Several counties	3/8/1995	Heavy Snow	0	0	50
Several counties	12/9/1995	Extreme Cold	0	1	2
Several counties	1/2/1999	Winter Storm	0	0	0
Several counties	1/8/1999	Winter Storm	0	0	0
Several counties	1/13/1999	Winter Storm	0	0	85
Several counties	3/9/1999	Heavy Snow	0	0	0
Several counties	12/13/2000	Winter Storm	0	0	0
Several counties	2/16/2003	Heavy Snow	0	0	200
Several Jurisdictions	12/4/2004	Ice Storm	0	0	
Several counties					250

## **Hazard Profile – Winter Storms**

### **Hazard Characteristics**

Winter storms begin as low-pressure systems that move through Ohio either following the jet stream or developing as extra-tropical cyclonic weather systems over the Atlantic Ocean called “Nor’easters.” The effects of these storms can sometimes last for weeks, bringing several inches or even feet of snow and ice and cold temperatures.

### **Probability of Occurrence**

Winter storms occur several times a year in Ohio. The NCDC estimates that Coshocton County has a 5 percent annual chance of equaling or exceeding accumulated snow depths of 20 to 30 inches. Mean annual snowfall is 15 inches per year.

### **Severity**

A winter storm can adversely affect roadways, utilities, business activities and can cause loss of life, frostbite, or freezing. Winter storms may contain one or more of the following hazardous weather events:

**Heavy Snowstorm:** Accumulations of four inches or more in a six-hour period, or six inches or more in a twelve-hour period.

**Sleet Storm:** Significant accumulations of solid pellets, which form from the freezing of raindrops or partially melted snowflakes, causing slippery surfaces posing hazards to pedestrians and motorists.

**Ice Storm:** Significant accumulations of rain or drizzle, freezing on objects (trees, power lines, roadways, etc.), as it strikes them, causing slippery surfaces and damage from the sheer weight of ice accumulation.

**Blizzard:** Wind velocity of 35 miles per hour or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period of time.

**Severe Blizzard:** Wind velocity of 45 miles per hour, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

Note that all townships and villages in the county are essentially at equal risk from winter storms, although weather impacts may vary somewhat over the county, due to topography and other factors.



## **Hazard Vulnerability – Winter Storms**

### **Existing Community Assets**

In Coshocton County, wintertime snow accumulations are expected and normal. The most common, but potentially serious effect of very heavy snowstorms with accumulations exceeding six or more inches in a 12-hour period are traffic accidents; interruptions in power supply and communications; and the failure of inadequately designed and/or maintained roofing systems. Similar to the discussion under tornadoes, vulnerability to the effects of winter storms on buildings is dependent on the age of the building (and what building codes may have been in effect at the time), type of construction, and condition of the structure (i.e., how well has the structure been maintained). Individual structure data was not available for this study, so it was difficult to determine the exact number and types of structures within Coshocton County that have heightened vulnerability to winter-storm snow loading.

### **Future Development**

As with high winds, the Capability Assessment portion located in Section 2 identifies communities that do not, as yet, have an adopted building code, which limits the probability that new construction will be able to resist design snow loads.

### **Conclusions – Winter Storms**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

### **Summary of Hazard Vulnerability Assessment**

Ohio and Coshocton County are vulnerable to winter storms. Heavy snowstorm, sleet storm, ice storm, blizzard and severe blizzard are the types of winter storms possible in Coshocton County. Due to the frequency of past events and a relatively high annual probability for high snow depths, winter storms are very likely to continue affecting normal activity in the county in the coming years.

### **What Can Be Mitigated?**

The nature of much of the severe weather hazards is that the entire county can be affected. There are no hazard zones, and every area within the county is equally exposed, although weather impacts may vary somewhat according to topography and other factors. For all severe storm events – including tornadoes

and severe winter storms – aged, dilapidated, or buildings not adequately built or not built to applicable building codes are more susceptible to wind and weather hazards. Manufactured housing (mobile homes) is especially susceptible to wind events. Strong winds can rip roofs off houses, overturn manufactured homes, or cause total failure of poorly constructed structures. Gable-ended roofs are also especially vulnerable to strong winds. Aged or otherwise compromised structures are also susceptible to snow loads if their roofing systems are not built to applicable standards. For that reason, vulnerability and determining what can be mitigated are described in terms of structures or infrastructures that are most vulnerable to the hazard.

## **Earthquakes**

### **Overview – Earthquakes**

The Ohio Geological Survey has recorded five earthquakes in Ohio since 1937 that had a magnitude of 4.5 (as measured on the Richter Scale) or more. None of these had their epicenter in Coshocton County (see Figure 5). Historic earthquake activity is part of determining vulnerability to damage from future earthquakes. However, the Ohio DNR notes that the 200-year data record for earthquakes is an instant in geologic time and forms a poor basis for assessing the probability of future events. The assessment of risk is made more difficult because the faults generating the tremors are buried deeply underneath several thousand feet of sedimentary rock.

One acceptable technique for gauging relative risk is the probability associated with peak ground acceleration (PGA) as determined by the United States Geological Survey (USGS). PGA measures the strength of ground movements in this manner. PGA represents the rate in change of motion of the earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity.

### **Probability of Occurrence**

Data from the USGS web site indicates that Coshocton County is an area of relatively minor earthquake risk, e.g., there is only a 10 percent probability that PGA will exceed three percent within a 50-year period. Ground acceleration usually must exceed 15 PGA for significant damage to occur, although soil conditions at local sites are extremely important in controlling how much damage will occur as a consequence of a given amount of ground acceleration.

### **Previous Occurrences – Earthquakes**

As stated before, there have been a limited number of earthquakes to have hit Coshocton County and none of the epicenters have been in the county. Even

though the probability of having a severe earthquake over a magnitude of 5 would be very low, the effects on the county would be detrimental.

**Table 15 Previous Occurrences**

DATE	LOCATION	MAGNITUDE	DAMAGE
9/26/1884	County Wide	Unknown	0
12/14/1886	County Wide	Unknown	0
2/1/1986	County Wide	5.0	0

## **Hazard Profile – Earthquakes**

### **Hazard Characteristics**

Large numbers of earthquakes occur on a daily basis on Earth, but the majorities of them are detected only by seismometers and cause no damage (magnitude 5).

Most earthquakes occur in narrow regions around plate boundaries down to depths of a few tens of kilometers, where the crust is rigid enough to support the elastic strain. Where the crust is thicker and colder, they will occur at greater depths and the opposite in areas that are hot. At subduction zones, where plates descend into the mantle, earthquakes have been recorded to a depth of 600 km, although these deep earthquakes are caused by different mechanisms than the more common shallow events. Some deep earthquakes may be due to the transition of olivine to spinel, which is more stable in the deep mantle.

### **Severity**

If Coshocton County was hit by an earthquake of magnitude greater than 5.0, the damages would be very severe. The severity of an earthquake can be expressed in terms of both intensity and magnitude. However, the two terms are quite different, and they are often confused.

Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region, depending on the location of the observer, with respect to the earthquake epicenter.

Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value.

## **Hazard Vulnerability – Earthquakes**

### **Future Development**

Since Coshocton County has not been affected by earthquakes, using earthquake building codes would not be cost beneficial to the county.

### **Conclusions – Earthquakes**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

### **Summary of Hazard Vulnerability Assessment**

Ohio and Coshocton County are vulnerable to earthquake activity. Ohio and Coshocton County experience several earthquakes every year that hardly ever exceed a magnitude of 2.0. These quakes can cause severe problems if they were to reach a higher magnitude, such as power loss, structural damages and among other obvious adverse effects.

There is not sufficient data to conduct a detailed calculation of earthquake losses.

## **Overview - Drought**

### **Drought**

Another type of severe weather is drought, which is a period of prolonged dryness that contributes to depletion of ground-water and surface-water yields. When droughts occur, they can have significant adverse consequences to:

- Public water supplies for human consumption;
- Rural water supplies for livestock consumption and agricultural operations;
- Water quality;
- Natural soil water or irrigation water for agriculture;
- Water for forests and for fighting forest fires; and
- Water for navigation and recreation.

Because of the number of affected groups and sectors associated with drought, its spatial extent, and the difficulties connected with quantifying environmental

damages and personal hardships, the accurate determination of the financial costs of drought is an arduous task. It has been estimated that the average annual impacts of drought in the United States are between \$6 and \$8 billion. However, during the drought years of 1976 to 1977 and 1988, government estimates of impacts were \$36 billion and \$40 billion, respectively.

### **Previous Occurrences – Droughts**

Even though the probability of having a drought in Coshocton County is low, there have been previous occurrences of it.

**Table 16 Previous Occurrences Droughts**

DATE	LOCATION	DAMAGES
7/12/1988	County Wide	Unknown
7/1991	County Wide	Unknown

### **Probability of Occurrence**

Drought is a normal part of virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. There are few documented occurrences of severe drought in Coshocton County, so the relative risk of drought is considered low.

### **Hazard Profile – Drought**

#### **Hazard Characteristics**

Drought is an insidious hazard of nature. Although it has scores of definitions, it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evaporation in a particular area, a condition often perceived as “normal”. It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity.

#### **Severity**

The severity of the drought depends not only on duration, intensity, and geographic extent of the drought, but also on the demands made by human activities and vegetation on regional water supplies. The state uses several parameters to assess drought conditions. These include stream flows (compared to benchmark records), precipitation (measured as the deviation from average precipitation); reservoir storage levels in a variety of locations, groundwater elevations in a number of counties (compared to historic record), and the Palmer Drought Index, a measure of soil moisture computed by the National Weather Service.

## **Hazard Vulnerability – Drought**

### **Existing Community Assets**

Coshocton County does not have any community assets to support the county during a drought.

### **Future Development**

The Emergency Management Agency would like to develop an emergency operations plan for a drought that would include;

- Public information and education campaigns
- Emergency conservation programs
- Restrictions on nonessential uses of water
- Prohibition of selected commercial uses
- Drought emergency pricing
- Water rationing programs
- Augmentation
- Better tracking devices
- Improvements in water systems (for example, leak detection)
- Emergency sources of supply (for example, emergency interconnections, drilling new wells)
- Management of available water resources (for example, emergency water banks, over drafting of groundwater aquifers)
- Search for new supplies of water

## **Conclusions – Drought**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

## **Summary of Hazard Vulnerability Assessment**

Drought is a natural hazard that can occur at any time. In Ohio and Coshocton County, a drought is most likely to occur in the summer months from May to October. This is when most farmers are growing their crops and the demand for water in Coshocton County has increased. Using better tracking devices to determine if the county is going to have a drought, will better prepare the county and help to educate the public to conserve water, lessening the effects of a drought.

### **Class One Dam**

#### **Overview - Class One Dam**

Dam failures can pose a serious threat to communities located downstream from major dams. The county has two dams (Mohawk and Wills Creek), which are classified in the high hazard category because they pose a potential significant threat to residents and property. The hazard designation relates to hydraulic potential (height and/or storage), and the number relates to downstream population. Inundation maps have been developed for these dam failures. Buckhorn Lake is a high hazard dam that could impact Coshocton County residents, but this dam is located in adjacent Holmes County. The inundation map for this dam is presented as Figure 6.

#### **Probability of Occurrence/ Severity**

The hazard from these dams is limited by structural integrity and inspection programs, and thus the relative risk is considered low. There are no documented dam failures in Coshocton County.

Mohawk Dam has been in service for 70 years but was only built with the expectation that it would function for around 50 years before sedimentation and erosion weakened the dam. The dam has weakened and several safety issues have arisen, which is why the United States Army Corps of Engineers (USACE) has placed it on its list of the nation's most at-risk dams, where it ranked seventh most at-risk in 2006. In 2007, the dam was classified as "Urgent", which is the second-highest classification level of the dam safety rating system used by the USACE. This classification indicates that the dam is a high federal priority for repairs since failure of the dam during a flood is moderately uncertain. The Muskingum Watershed Conservancy District (MWCD) estimates that if the Mohawk Dam were to fail during a flood, the water normally held back could cost 307 people their lives and up to \$449 million in property damage.

According to the MWCD, the dam's greatest problem is the inherent downstream seepage that occurs with most earthen dams. In the case of the Mohawk Dam,

this condition is exacerbated by the fact that it was built on highly permeable land, which could cause instability if too much water were to seep through the lower part of the dam.

Wills Creek Dam is on the boarder of Coshocton County and Muskingum County. Wills Creek is formed by a confluence of short forks near Pleasant City in southern Guernsey County, and initially flows northwardly through Byesville, Cambridge and Kimbolton. Near Kimbolton it turns westwardly and flows through southeastern Coshocton and northeastern Muskingum Counties, past Plainfield, to its mouth at the Muskingum River, 8 mi south of Coshocton City. Near its mouth, the flood-control dam causes the creek to form Wills Creek Lake.

If a dam was to fail, the damages would vary depending on the level of water supported by the dam. If it was a significant amount of water, the county would be flooded and would suffer major losses.

### **Previous Occurrences – Class One Dam**

Mohawk Dam has never had any previous occurrences where it failed. The dam had several success stories from saving Coshocton County from millions worth in damages. Some examples include March 10, 1964 when the county was hit by several inches of rain followed by several inches of snow. There was 69.2 feet behind Mohawk Dam, which was a record high. In estimation, the Muskingum Watershed Dams and reservoirs, which include the Mohawk Dam, saved \$52,022,000 in potential damage. The record has then been beat in January 2005 when the levels reached a height of 80.01 feet above its normal level. This created awareness that the dam required more maintenance since it has exceeded its length of use.

On January 16, 2005 the Wills Creek Dam became the only dam in the Army Corps of Engineers Huntington District's history (established 1938) to reach its spillway elevation and have water flow uncontrolled over the top of the spillway. On that day Wills Creek Lake was 37 feet above its normal level of 749 feet (above sea level), and spanned 20,452 acres, causing it to be the largest man-made lake in the state of Ohio.

### **Hazard Profile – Class One Dam**

#### **Hazard Characteristics**

Mohawk and Wills Creek Dam were authorized by the Flood Control Act of 1938 and were built, along with 13 other dams, to control flooding within the



Muskingum River watershed. Work began in April 1935 and was completed in September 1937. They have been serving their function faithfully ever since.

In another flood example, when the dam reached a record high of 81 feet on January 15, 2005, again the ground had been frozen and the area was hit with a significant amount of rain. Mohawk Dam was successful at retaining the water from Coshocton County for over two months while the water returned to the normal level. However, after this occurrence the Army Corp of Engineers realized that certain maintenance needs to be done on the dam to assure its capabilities. The Army Corp of Engineers has received a grant for \$65 million to repair the dam and this will be started in 2012.

### **Hazard Vulnerability – Class One Dam**

#### **Future Development**

Continuing to monitor the Class One dams in Coshocton County is vital for the survival of the dams. In order to keep up proper dam maintenance, the dams need to be constantly monitored and assessed.

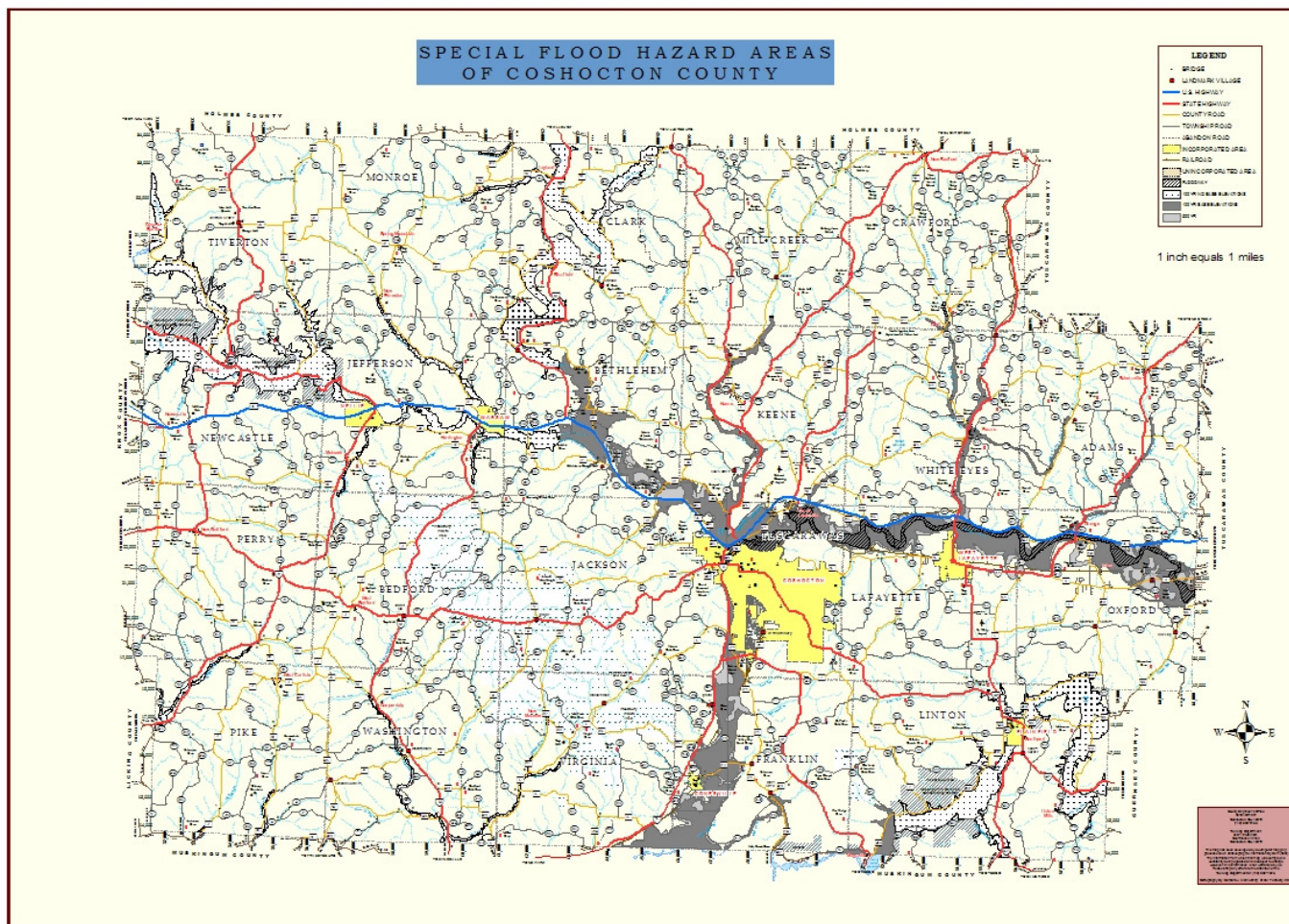
### **Conclusions – Class One Dam**

The following summarizes the salient points identified during the hazard identification, profiling and vulnerability assessment portions of the work that are carried forward as part of the planning process.

#### **Summary of Hazard Vulnerability Assessment**

Ohio and Coshocton County are vulnerable to class one dam failure. Coshocton County is especially vulnerable to failure from the Mohawk Dam if the dam was not properly maintained. Coshocton County experiences several rain storms and snow falls each year that cause the rivers to rise. Properly maintaining the dam when water levels are below or normal is crucial for the county. If the dam would fail, the damages could reach over \$50 million.

### Figure 2 County Floodplain Map



**Figure 3 Tornado Activity in the United States**

Source: FEMA 386-2, Understanding Your Risks

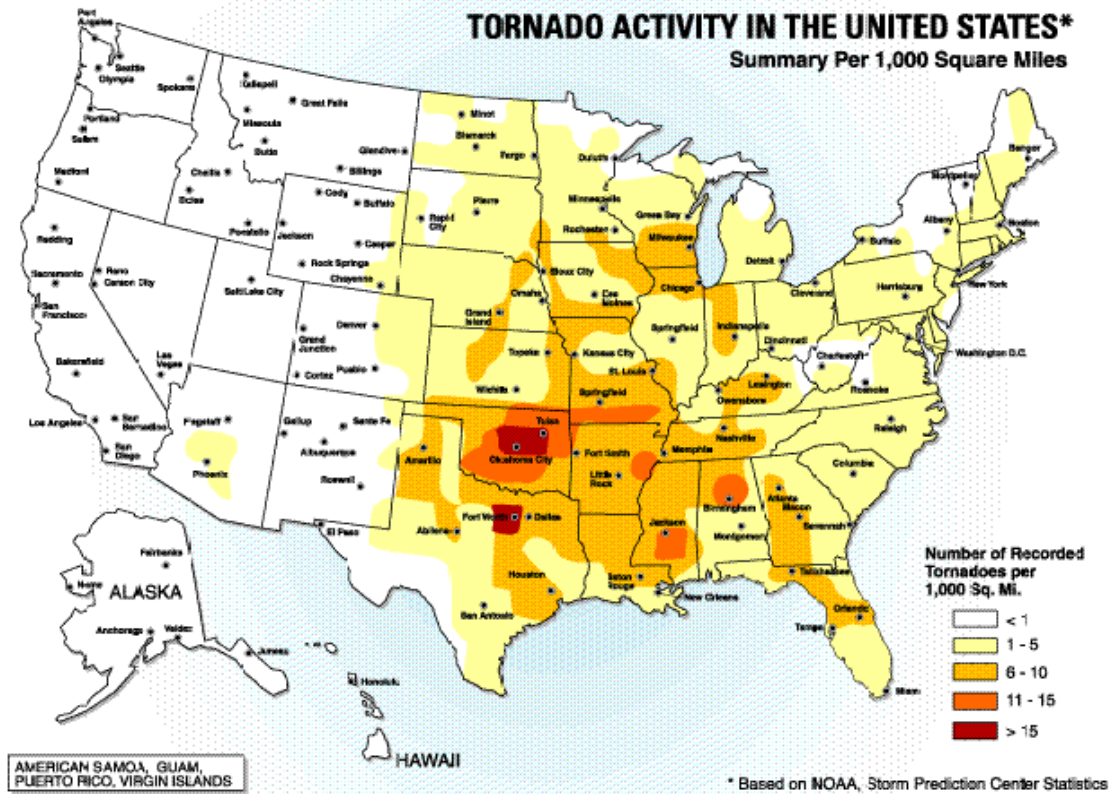


Figure I.1 The number of tornadoes recorded per 1,000 square miles

**Figure 4 Wind Zones in the United States**

Source: FEMA 386-2, Understanding Your Risks

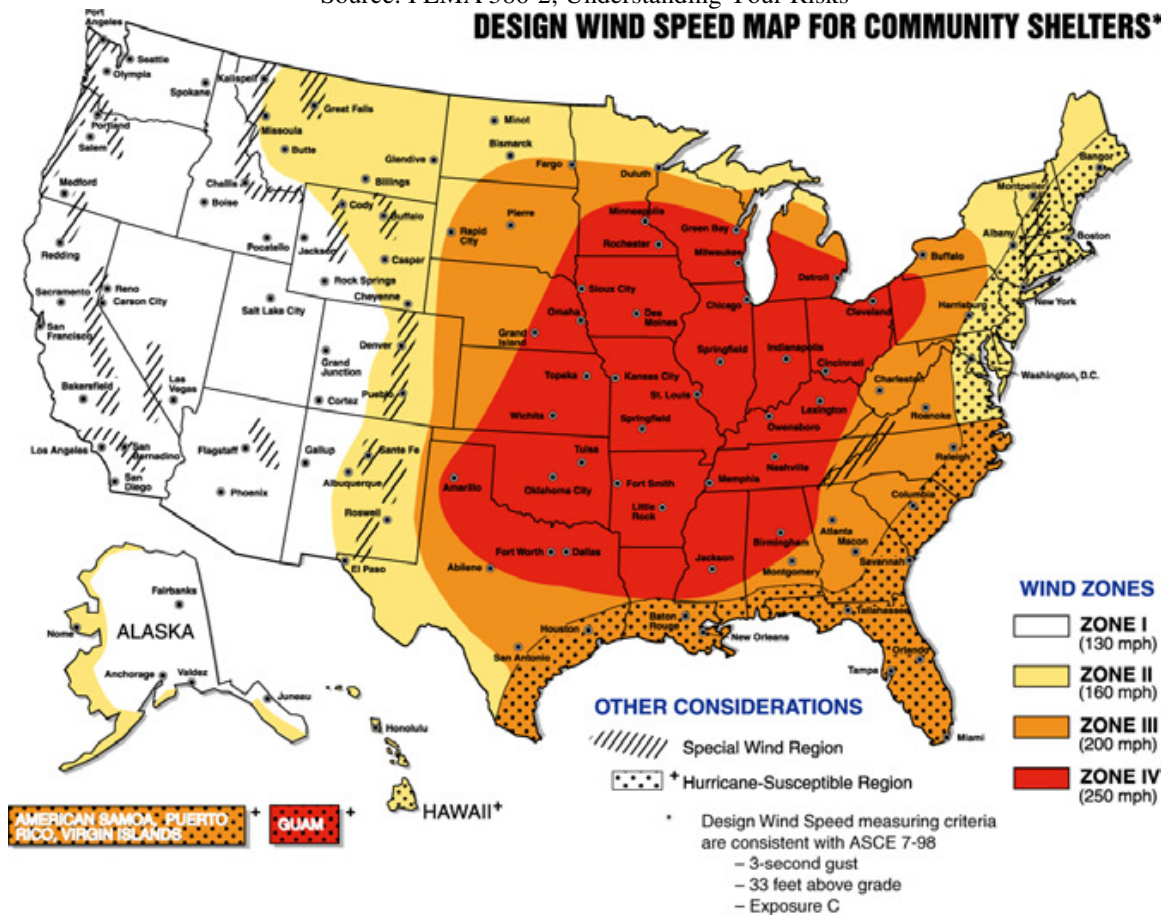




Figure 5 Earthquake Epicenters in Ohio



## **Figure 6 Inundation Map**

**Attachment 1 Inundation Map of Mohawk Dam, Wills Creek Dam and Buckhorn.  
(Which includes only the part of that runs through Coshocton not Holmes County.)**

## **Section Two Mitigation Capabilities and Resources**

Coshocton County has a number of resources that it can access to implement hazard mitigation initiatives. These resources include both private and public assets at the local, state, and federal levels.

### **Capabilities and Resources – Coshocton County**

Table 17 summarizes the local-government capabilities the county and the various jurisdictions possess that will facilitate implementation of the mitigation strategy.

Coshocton County and the 22 townships, five villages, and one city within its boundaries, have a very important relationship in which they share resources to ensure the effective implementation of ordinances and other programs. The county has implemented subdivision and land-use regulations and a flood-hazard-area development permit.

One of the most important capabilities that the jurisdictions utilize is the floodplain management resolution and the County Engineer Special Purpose Flood Damage Reduction Resolution #2010-13 of March 1, 2010. Through administration of these resolutions, the jurisdictions can ensure that all new construction or substantial improvements to existing structures, which are located in the 100-year floodplain, are built with first-floor elevations above the BFE. All unincorporated areas and three of the six municipalities have adopted floodplain management ordinances and participate in the NFIP; it is uncertain whether the other three incorporated areas have structures in the 100-year floodplain.

There is also a regional permit and inspection process for all commercial buildings per State guidelines that is administered through the Mid-East Ohio Building Department in Zanesville.

However, the county's capabilities for hazard mitigation need improvement in the following areas:

- Three of the incorporated areas do not have planning commissions, and none of them have comprehensive plans or land-use ordinances.
- Except for two of the incorporated areas, there are no zoning ordinances in the county.
- Other than the regional program for commercial buildings, there are no building codes in the county.

Table 17 Local Capability Assessment Matrix						
Municipality Name	Planning Commission	Comprehensive Plan	Zoning Ordinance	Land Use Ordinance <sup>15</sup>	Residential Building Code	Floodplain Resolution
Incorporated Areas						
Conesville						
Coshocton City	X		X			X
Nellie						
Plainfield						
Warsaw	X					X
West Lafayette	X		X			X
Unincorporated Areas (Townships)						
Adams	X			X		X
Bedford	X			X		X
Bethlehem	X			X		X
Clark	X			X		X
Crawford	X			X		X
Franklin	X			X		X
Jackson	X			X		X
Jefferson	X			X		X
Keene	X			X		X
Lafayette	X			X		X
Linton	X			X		X
Mill Creek	X			X		X
Monroe	X			X		X
Newcastle	X			X		X
Oxford	X			X		X
Perry	X			X		X
Pike	X			X		X
Tiverton	X			X		X
Tuscarawas	X			X		X
Virginia	X			X		X
Washington	X			X		X
White Eyes	X			X		X

Source: Coshocton County and NFIP



There are several planning mechanisms available for incorporating the requirements of the hazard mitigation plan into other planning mechanisms, such as comprehensive plans or capital improvement plans (see Table 17 and other text in this section). In addition, there are mitigation strategies and actions in this plan that relate to the aforementioned planning mechanisms as implementation tools (see Sections 4 and 5). Furthermore, this hazard mitigation plan will become a component of the county comprehensive plan, and any municipal comprehensive plans are required to be consistent with the county's comprehensive plan. This hazard mitigation plan may also become integrated with the county's emergency operations plan.

### **Other Local Resources**

Local organizations that could act as partners for future mitigation action include:

- Banking and real estate businesses,
- Business development organizations, like the Chamber of Commerce, and
- Historical and cultural agencies, like the Coshocton County Historical Society

### **Capabilities and Resources – State Of Ohio**

Coshocton County may be able to access several of the resources offered by the State of Ohio.

The Ohio Department of Natural Resources (ODNR) provides technical and planning assistance to local governments to reduce flood losses.

ODNR's Division of Soil and Water Conservation provides funding for urban storm water specialists to support local storm water management efforts.

The planning branch of OEMA has access to several resources from which the county may benefit, including:

- The Hazard Mitigation Grant Program, which provides funding and technical assistance to local communities following disasters;
- The Flood Mitigation Assistance Program, which provides funds and technical assistance for cost-effective flood studies and mitigation projects;
- The Pre-disaster Mitigation Grant Program, which funds pre-disaster mitigation planning, projects, and other activities at the local level.

The Ohio Department of Development's Community Development Division administers programs that help rehabilitate communities and neighborhoods through affordable housing and infrastructure improvements through Community Services Block Grants and provides energy-efficiency assistance with the Energy Efficiency Skills for Professionals training program.

There are several state training programs available for Coshocton County and municipal government staff, which can better equip them to handle hazard mitigation activities. OEMA also offers training in conjunction with FEMA for emergency management and hazard mitigation activities. As part of Ohio's anti-terrorism initiative, a task force on security has launched proposals geared to strengthening emergency preparedness, quickening response and enhancing communication and coordination at all levels.

### **Capabilities and Resources – Federal Resources**

The federal government offers a number of mitigation-related funding and training resources. Funding opportunities, such as the Pre-Disaster Mitigation Assistance program, the Flood Mitigation Assistance Program, and the Hazard Mitigation Grant Program, require local governments to have a hazard mitigation plan in order to be eligible to receive such grants. Other possible funding sources include Community Development Block Grants and the Small Business Administration. The relationship between these funding sources and potential mitigation actions will be explained as part of the implementation strategy for this plan.

Through the Emergency Management Institute, the federal government offers training in all aspects of emergency management, including hazard mitigation. The courses available at the Institute are free to local government staff.

Other federal resources include:

Weatherization Assistance Program: Minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services, like heating system modifications and insulation.

Section 108 Loan Guarantee Programs: Provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.

US Army Corp of Engineers: Provides planning and technical assistance for a wide range of activities, including flood-damage reduction, dam safety, and emergency response.

US Department of Agriculture: Provides disaster assistance through the following:

- The Emergency Conservation Program provides emergency funding for farmers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures during periods of severe drought.
- The Non-insured Crop Disaster Assistance Program provides financial assistance for non-insurable crop losses and planting prevented by disasters.

Emergency Watershed Protection Program: Undertakes emergency measures, including the purchase of floodplain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed. It is not necessary for a national emergency to be declared for an area to be eligible for assistance. The program objective is to assist sponsors and individuals in implementing emergency measures to relieve imminent hazards to life and property created by a natural disaster. Activities include providing financial and technical assistance to remove debris from streams, protect destabilized stream banks, establish cover on critically eroding lands, repairing conservation practices, and the purchase of flood plain easements. The program is designed for installation of recovery measures.

Other potential federal resources are listed in Appendix D.

## **2.4 Conclusion**

After conducting the mitigation capability assessment, the conclusion was reached that the county will need to rely on technical and financial assistance from regional, state, and federal resources to effectively implement hazard mitigation actions over the next five years. The constraints facing the county include limited staff resources and funds that can be directed to implementing hazard mitigation.

During the development of this plan and from reviewing other recent planning initiatives, it is readily apparent that the county has the capability to bring together citizens, government representatives, and local officials to work closely together in crafting a better future for their communities. That same cooperative effort, if joined with the appropriate technical and financial assistance from regional, state and federal resources, can be harnessed to implement the priority hazard mitigation actions described in Section Four of this plan. A sustained effort by the citizens, staff, and local officials can create a more sustainable and disaster-resistant future for Coshocton County.

## Section Three Mitigation Goals and Objectives

### Mitigation Goals and Objectives

Present a series of goals and objectives to help guide the county in building its disaster resistance and the alternative mitigation measures considered to address its hazard vulnerabilities. These goals and objectives address the vulnerabilities discussed in Section One.

The hazards were then prioritized using a Benefit-Cost Review process. This approach demonstrates that the actions are being evaluated in terms of their pros and cons, which are represented as costs benefits.

### Terminology

- **Goals** are general guidelines that explain what you want to achieve. Goals are usually expressed as broad policy statements representing desired long-term results.
- **Objectives** describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date.
- **Actions** provide more detailed descriptions of specific work tasks to help a community achieve the goals and objectives. For each objective statement, there are alternatives for mitigation actions that must be evaluated to determine the best choices for each situation (see Section Three: Alternative Mitigation Actions).
- **Mitigation Plan** includes a listing and description of the preferred mitigation actions and the strategy for implementation, i.e., who is responsible, how will they proceed, when should action be initiated and/or completed, etc. (see Section Four: Mitigation Plan and Implementation Strategy).

This section of the **Hazard Vulnerability Assessment and Mitigation Plan for Coshocton County**, Ohio identifies the goals and objectives for the project. In meetings held in 2009, citizens and local government representatives reviewed and prioritized goals and objectives based on the findings of the vulnerability assessment. Participants felt that priority should be given to mitigation actions that protect people, property, local government functions, and the local economy from the effects of hazards.

The goals developed for the Coshocton County Hazard Mitigation Plan are listed in the following document and were developed in response to the vulnerability findings presented in Section One and the desires of Coshocton County citizens.

## Goals

Reduce possibility of injury/death to county residents and reduce potential damage to existing community assets (including critical facilities and infrastructure) due to:

- Flooding;
- Tornadoes
- Wind storms
- Drought
- Severe Weather
- Class One Dams and;
- Earthquakes

There are six general approaches to reducing hazard risks:

- Preventive measures,
- Property protection,
- Emergency services measures,
- Structural projects,
- Natural resource protection, and
- Public information.

**Preventive Measures** keep problems from getting started or getting worse. The use of known hazard areas, like floodplains for example, can be limited through planning, land acquisition, or regulation. These activities are usually administered by building, zoning, planning, and/or code enforcement officials:

- Planning and zoning,
- Open space preservation,
- Building codes and enforcement,
- Storm water management, and
- Drainage system maintenance.

**Property Protection** measures are those actions that go directly to permanently getting people, property, and businesses out of unsafe areas where, in terms of wise disaster planning, they shouldn't have been in the first place.

The first of these measures is property acquisition: public procurement and management of lands that are vulnerable to damage from hazards. For example, flood-damaged homes have been purchased by municipalities (using state, federal, and local funds) and removed from flood-prone areas (by demolition or relocation). The acquired land then becomes public property, which can only be used as "open space" in the future. Open space use means that future

development of the site is restricted to low-impact uses like parks, playing fields, gravel parking lots or agriculture--no permanent or enclosed structures. Relocation of at-risk structures also achieves the same result as acquisition. The home or business is moved to a safer location, but it remains the property of the individual owner, while the original site is purchased and maintained by the local municipality.

Elevation of structures can be effective in-place mitigation for some flood-threatened homes. By raising the height of the structure's living area above flood levels, damage and threat to life can be reduced. Retrofitting of homes is another in-place damage reduction method. Utilities, services, systems and appliances in some homes can be raised above flood levels.

Construction techniques to improve structural resistance to high wind or heavy snow accumulation can be incorporated into new homes or retrofitted into existing structures.

Private home and business insurance policies and participation in the National Flood Insurance Program can also reduce uninsured losses to properties.

**Emergency Services Measures** are taken during a disaster to minimize its impact. These measures are the responsibility of city or county emergency management staff, operators of major and critical facilities, and other local emergency service organizations. They include:

- Alert warning systems,
- Monitoring systems,
- Emergency response planning,
- Evacuation,
- Critical facilities protection, and
- Preservation of health and safety.

**Structural Projects** are usually designed by engineers and managed and maintained by public works staffs. They are designed to reduce or redirect the impact of natural disasters (especially floods) away from at-risk population areas. Examples include:

- Reservoirs
- Levees, floodwalls
- Diversions
- Channel modifications
- Storm sewers

**Natural Resource Protection** preserves or restores natural areas or their natural functions. Such measures are usually implemented by park and recreation organizations, conservation agencies or wildlife groups. They include:

- Wetland protection,
- Best management practices,
- Erosion and sediment control, and
- River bank protection.

**Public Information Programs** advise property owners, potential property owners, and others, of hazards and ways to protect people and property from them. Public information activities can include:

- Flood maps and data
- Library resources
- Outreach projects
- Technical assistance
- Real estate disclosure information
- Environmental education programs

## **Objectives**

The mitigation actions in Section 3 were used to develop draft objectives. These objectives addressed in more specific terms, the results of the vulnerability assessment and reflected the nature of what can be mitigated for the identified hazards, as well as existing limitations in data and information. These draft objectives were presented to the HMCC for review and comment, and shown in final form in Section 3.

## **Section Four: Mitigation Plan and Implementation Strategy**

Contains prioritized actions accompanied by details about the responsible organizations, estimated costs, possible funding sources and the timeline for implementation. This section concludes with a discussion of Monitoring, Evaluation and Updating, which recommends establishing a permanent hazard mitigation team to effectively lead the implementation of the plan and continuation of the hazard mitigation planning process beyond this plan.

In public meetings held in 2009, citizens and local government representatives discussed the findings of the vulnerability assessment and their implications for mitigation strategies. They expressed the chief desire that mitigation objectives should maintain the rich historic, recreational, and agricultural fabric of the community. Furthermore, objectives should recognize the necessity of commercial interests. First and foremost, however, mitigation objectives should protect people, property, local governments, and the local economy from the effects of hazards.

With regards to the hazard identification approach indicated by §201.6(c)(2)(i) of the DMA 2000 Plan Review Criteria, the table following is a description of the hazards that were identified, how they were identified, and why they were identified. Hazard identification involved a combination of input from concerned residents and preliminary research from State of Ohio resources, like OEMA and the Ohio Department of Natural Resources (DNR).

After identifying possible hazards, data available online from the United States National Climatic Data Center (NCDC), United States Geological Survey (USGS), OEMA, and other sources were used to further investigate the possible occurrence of a range of hazards. The data sets used to generate the assessment were sometimes out-of-date; therefore, hazard probabilities and severity in this document were at times discussed in broad terms in light of available information. These data limitations are discussed in the appropriate sections.

The mitigation options presented in this section were evaluated in light of the expressed desires of the community using the following criteria, which assess the suitability of options based on their social effect on the county and municipalities, their technical feasibility, and their support with residents and local officials. The Staple+E evaluation method (see table below) categorizes these factors into social, technical, administrative, political, economic, and environmental criteria.

**Table 18 Staple + E Criteria**

<b>Criteria</b>	<b>Considerations</b>
<b>Criteria Considerations</b> <ul style="list-style-type: none"> <li>• What are the legal side effects?</li> <li>• Will the community be liable for the actions or support of actions, or lack of action? Is it likely to be challenged?</li> </ul>	
<b>Social</b>	<ul style="list-style-type: none"> <li>• Will it cause any one segment of the population to be treated unfairly?</li> <li>• Will the action disrupt established neighborhoods, break up voting districts or cause the relocation of low and moderate income people?</li> <li>• Is the action compatible with present and future community values?</li> <li>• Will the measures adversely affect cultural values or resources?</li> </ul>
<b>Technical</b>	<ul style="list-style-type: none"> <li>• How effective is the measure in avoiding or reducing future losses?</li> <li>• Will it create more problems than it solves?</li> <li>• Does it solve a problem or only a symptom?</li> <li>• In light of other community goals, is it the most useful?</li> </ul>
<b>Administrative</b>	<ul style="list-style-type: none"> <li>• Does the community have the capability to accomplish the</li> </ul>



	action (i.e. can you implement the mitigation action)? <ul style="list-style-type: none"> <li>• Can the community provide any maintenance necessary?</li> <li>• Is there enough staff, technical experts and funding?</li> <li>• Can it be accomplished in a timely manner?</li> </ul>
<b>Political</b>	<ul style="list-style-type: none"> <li>• Who are the stakeholders in this proposed action?</li> <li>• Have all of the stakeholders been offered an opportunity to participate in the planning process?</li> <li>• How can the mitigation goals be accomplished at the lowest cost to the stakeholders?</li> <li>• Is there public support both to implement and maintain this measure?</li> <li>• Is the political leadership willing to propose and support the favored measure?</li> </ul>
<b>Legal</b>	<ul style="list-style-type: none"> <li>• Does the community have the authority to implement the proposed measure?</li> <li>• Is there a clear legal basis for the mitigation action? Is an ordinance or resolution necessary?</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>• What are the costs and benefits of this measure?</li> <li>• How will the implementation of this measure affect the pocketbook of the community?</li> <li>• Does the cost seem reasonable for the size of the problem and likely benefits?</li> <li>• What burden will be placed on the tax base or local economy?</li> <li>• Does the action contribute to other community economic goals such as capital improvements or economic development?</li> <li>• What benefits will action provide?</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>• How will this action affect the environment?</li> <li>• Will this measure comply with local, state and federal environmental regulations?</li> <li>• Is the action consistent with community environmental goals?</li> <li>• Are endangered or threatened species likely to be affected?</li> </ul>

Source: FEMA publication 386-3, developing the Mitigation Plan

Using STAPLE+E criteria, the mitigation alternatives were scored as shown in Table 18. Note that costs and benefits of the various mitigation actions were considered during the prioritization process under the “economic” element of the STAPLE+E criteria. In addition, the economic score of each alternative was weighted more heavily in determining the final score. As an example of this, note that action 1.D.2 (obtaining detailed information on all properties in the floodplain) in Table 18 is much less cost-effective than action 1.A.1 (evaluating cost-effective protection of critical facilities), and therefore the former was rated a “0” under the “economic” element as compared to a “2” for the latter.

Section Five of this plan reflects the results of a meeting of the Coshocton County HMCC on November 19, 2009, at which time the committee members identified priority mitigation action items that are included in the resulting implementation mitigation actions.

**Table 19 Prioritizing Mitigation Actions for Coshocton County**

The Benefit-Cost Review was emphasized in the prioritization process. This approach demonstrates that the actions are being evaluated on terms of their pros and cons which are represented as cost benefit-cost review. Table 19 Mitigation actions were ranked and prioritized by the HPCC. These actions are not all the actions the HPCC would like to review for the next five years, but was a ranking system to determine which actions the county could feasibly focus on for the next five years. After this ranking, the decided mitigation actions will follow this chart.

Mitigation Action	Social	Technical	Administrative	Political	Legal	Economic	Environmental	Priority	TOTAL	Rank in Categories
<b>A. FLOODING</b>										
Educate residents in high risk area of "warning signs" of flash floods	3	3	1	2	3	2	3	1	18	5
Increase public awareness of flooding-especially flood prone areas	3	3	2	3	3	2	3	2	21	1
Evaluate stricter development standards and management of floodplains with countywide coordination	3	2	1	2	3	2	3	1	17	9
Determine areas of concern in regard to infrastructure that is continually being damaged or destroyed during a flood event	3	2	1	2	3	2	3	1	17	8
Increase service area able to cover with early warning detection for residents	3	2	1	3	3	2	3	1	17	6
Educate landowners as to their responsibility for stream maintenances	3	2	0	3	3	0	3	0	14	10
Create County Program (continuous) for stream maintenance	3	3	1	3	2	1	3	1	17	7
Look into techniques to prevent driving through water	3	2	1	3	3	2	3	1	18	4
Adopt county-wide flood plain areas	3	2	1	3	3	2	3	1	18	3
Update any county locations that need to be or are on NFIP	1	1	3	1	2	2	1	3	14	11
Set up at the annual fair educational information of NFIP	3	3	1	3	3	3	2	2	20	2

Work with existing floodplain residents to elevate or flood proof their structures, including obtaining funding assistance, create buy-outs, retrofit existing structures and/or utilities	2	1	2	3	1	3	2	0	14	12
<b>B. SEVERE WEATHER</b>										
Evaluate the storms that have hit Coshocton County and make the public aware of the hazards	1	1	3	1	2	2	1	3	14	3
Look to change building codes on structures, reinforce the infrastructure.	3	3	1	3	3	3	2	2	20	1
Increase awareness of wind storms	0	2	3	0	2	1	1	2	11	4
Trim down all trees in the county that could possibly affect power lines or road ways.	3	0	1	3	3	2	3	2	17	2
<b>C. TORNADOES</b>										
Increase public awareness of safe zone structures throughout the county	3	3	2	1	3	1	3	2	18	1
Increase public awareness of safe zone structures in mobile home parks	2	0	0	2	1	2	3	2	12	2
<b>D. DROUGHT</b>										
Increase awareness and potential damaging effects of droughts.	3	2	1	3	3	2	3	1	18	2
Determine damaging effect of development on aquifers	3	2	1	3	3	2	3	1	18	3
Look at scenarios and potential damaging effect on the county	1	1	3	1	2	2	1	3	14	5
EMA needs to develop action plan for droughts.	3	3	1	3	3	3	2	2	20	1
Develop water rationing actions that will be implemented during a drought situation	3	0	1	3	3	2	3	2	17	4
<b>E. CLASS ONE DAMS</b>										
Evaluate class one dams and plans	3	3	2	3	3	2	3	2	21	1
Mohawk dam connect and work with staff to create an early warning system	3	3	1	2	3	2	3	1	18	2
<b>F. EARTHQUAKES</b>										
Increase awareness and damaging effects of earthquakes	3	2	1	3	3	2	3	1	18	1
Provide residents and builders with examples of how to build for earthquakes	3	2	0	3	3	0	3	0	14	2
Notes										
1. Ratings: 0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent										
2. Weighting based on number of county residents that are										

affected by hazard and the efficacy of the actions. 3. Environmental and legal rankings are shaded because (with the exception of a few legal issues) they are all rated as 3.							
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After reviewing the rankings and priorities of each mitigation action the committee then decided on what goals they would like to focus on for the next five years. This included in order:

1. Set up at the annual fair educational information of NFIP
2. Evaluate protection of critical facilities from flooding.
3. Evaluate Class One Dams Plans for early warning detection.
4. EMA needs to develop action plan for droughts.
5. Identify/evaluate protection for HAZMAT storage in floodplain

Not all the mitigations actions were changed from when the plan was previously submitted. Some of the initial mitigations actions were not feasible to the county, financially. These four mitigation actions that were taken from table 19 are analyzed in more detail in table 20. Table 19 was part of the planning process for the HPCC to determine what actions the county would be able to focus on for the next five years.

After developing and analyzing all natural hazards, the committee developed the new hazard mitigation actions then prioritized each action, first according to hazard, then according to each action under that hazard. A review of other components of the plan was conducted by the Committee and changes were presented for discussion and agreement by its members. All the information was compiled and used to update the Master Plan. These changes were tracked by comparing the original document to updated plan.

## Mitigation Actions and Implementation

### Implementation of Mitigation Actions

The implementation of mitigation actions is the last step of the planning process and involves reviewing the mitigation actions taken from table 19. Each of the four actions were analyzed by the HPCC, which included the goals, actions, affected municipalities, lead organization, estimated cost, possible funding and time line. This is included in the following table, table 20. These strategies were developed and prioritized by continued compliance with the NFIP. This was conducted by comparing the last mitigation actions to the present needs and threats to Coshocton County. The HMCC was given a list of critical facilities and natural hazards that threaten the county and prioritized them. From this information, the Coshocton County EMA and the HMCC analyzed and prioritized the mitigation actions for the county. These Mitigation Actions are the actions the HMCC has decided to focus on for the next five years. Some of the previous Hazard Mitigation actions were not feasible to the county financially and were stopped; some of the mitigation actions from the previous plan were carried over to this plan, but were reanalyzed by the HMCC.

**Table 20 Mitigation Actions**

<b>First Priority from table 19</b>	<b>Public outreach/education regarding floods</b>
<b>Hazards</b>	Floods
<b>Goals</b>	Provide public outreach/education regarding strategies (e.g., flood proofing) for property owners in 100-year floodplain. <ul style="list-style-type: none"><li>• Flash Flooding</li><li>• Driving through water TADD (Turn Around Don't Drown)</li><li>• Stream Maintenance</li><li>• NFIP, educate on new ordinances</li><li>• Early warning detection</li></ul>
<b>Actions</b>	Work with township/village officials to increase awareness of model floodplain ordinance and with property owners, including informational mailings to property owners in the 100-year floodplain, and sponsoring a series of workshops about costs and benefits of: <ul style="list-style-type: none"><li>• Acquiring flood insurance coverage, and</li><li>• Property acquisitions, relocation, elevation, dry flood proofing, and wet flood proofing.</li></ul>

	<ul style="list-style-type: none"> <li>Maintaining compliance with NFIP</li> </ul>
<b>Affected Municipalities</b>	All but, in particular, Coshocton City, Jackson Township, Tuscarawas Township, Lafayette Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.
<b>Responsible Organization</b>	Coshocton County Office of Emergency Management
<b>Estimated Costs</b>	Est. Annual \$10,000
<b>Possible Funding Sources</b>	Federal: HMGP, PDM
<b>Timeline for Implementation</b>	1/2010-1/2015

<b>Priority Two from table 19</b>	<b>Evaluate protection of critical facilities from flooding</b>
<b>Hazards</b>	Floods
<b>Goals</b>	Assess protection of existing critical structures with the highest relative vulnerability to the effects of flooding.
<b>Actions</b>	<ul style="list-style-type: none"> <li>Obtain more detailed information on each structure, including first-floor elevations, market and/or replacement value, construction type, etc.</li> <li>Determine which structures have the highest relative vulnerability.</li> <li>Conduct cost-benefit analysis to determine the best property protection methods to promote with the individual property owners.</li> </ul>
<b>Affected Municipalities</b>	All, but in particular, Coshocton City, Jackson Township, Tuscarawas Township, Lafayette Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.
<b>Responsible Organization</b>	Floodplain manager in Coshocton County

<b>Estimated Costs</b>	\$1,000
<b>Possible Funding Sources</b>	Federal: HMGP, PDM
<b>Timeline for Implementation</b>	1/2010-1/2011

<b>Priority Three from table 19</b>	<b>Evaluate Class One Dams Plans for early warning detection.</b>
<b>Hazards</b>	All Hazards
<b>Goal</b>	Coordinate with Wills Creek, Buckhorn and Mohawk Dam personnel to correlate plans for an early warning system for Coshocton County.
<b>Affected Municipalities</b>	All but in particular, Coshocton City, Jackson Township, Tuscarawas Township, Lafayette Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.
<b>Responsible Organization</b>	Army Corp of Engineers Wills Creek, Buckhorn and Mohawk Dam, Coshocton County EMA
<b>Estimated Costs</b>	\$1,000-\$5,000
<b>Possible Funding Sources</b>	Federal: HMGP, PDM
<b>Timeline for Implementation</b>	1/2011-6/2011

<b>Priority</b>	<b>Construct an action plan for droughts</b>
<b>Hazards</b>	Droughts
<b>Goal</b>	Encourage and facilitate the development of an action plan for a drought in Coshocton County. Include scenarios, water rationing actions, development of aquifers and education to the public.
<b>Affected Municipalities</b>	All but in particular, Coshocton City, Jackson Township, Tuscarawas Township, Lafayette

	Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.
<b>Responsible Organization</b>	Coshocton County EMA, Extension Office, Soil and Water
<b>Estimated Costs</b>	\$5,000-\$10,000
<b>Possible Funding Sources</b>	Federal: HMGP, PDM
<b>Timeline for Implementation</b>	January 2012-January 2013

<b>Priority Four from table 19</b>	<b>Identify/evaluate protection for HAZMAT storage in floodplain</b>
<b>Hazards</b>	Floods/Hazmat
<b>Goal</b>	<p>Identify and evaluate protection for hazardous material storage in floodplain.</p> <ul style="list-style-type: none"> <li>• Identify all storage of hazardous materials in floodplains by using NFIP maps (including non-addressable structures, such as propane tanks).</li> <li>• Evaluate alternative methods to minimize risk from existing storage areas.</li> <li>• Assess means to prevent future storage in floodplain</li> </ul>
<b>Affected Municipalities</b>	All, but in particular, Coshocton City, Jackson Township, Tuscarawas Township, Lafayette Township, Jefferson Township (including Nellie and Warsaw Villages), Bethlehem Township, Franklin Township, and Newcastle Township.
<b>Responsible Organization</b>	Coshocton County Office of Emergency Management
<b>Estimated Costs</b>	\$10,000-\$15,000
<b>Possible Funding Sources</b>	Federal: HMGP, PDM
<b>Timeline for Implementation</b>	1/2010-1/2015



**TABLE 21 PAST MITIGATION ACTIONS**

<b>Mitigation Action</b>	<b>Status</b>
Evaluate protection of critical facilities from flooding	Continued 11/09
Evaluate protection of repetitive flood loss assets	Deleted 11/09
Identify/evaluate protection for hazmat storage in floodplain	Continued 11/09
Public outreach/education regarding actions during emergency	Deleted 11/09
Identify residents with highest vulnerability to severe weather and implement protection measures	Deleted 11/09
Public outreach/education regarding floods	Continued 11/09
Address identified data limitations regarding lack of detailed information about characteristics of individual structures	Deleted 11/09
Disaster resistant future development	Deleted 11/09

## 5.2 Monitoring and Evaluation of the Plan

Monitoring, evaluation and updating of the Plan is critical to maintaining the relevance of the Plan. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains how the plan was updated, reviewed and analyzed and who will be responsible for monitoring, evaluation and updating and what those responsibilities entail. This section also lays out the method and schedule of these activities and describes how the public will be involved on a continued basis.

Coshocton County Emergency Management Agency is the permanent entity to be in charge and responsible for the plan maintenance processes of monitoring, evaluation and updating. This Plan recommends creating a permanent planning group, the Coshocton County Hazard Mitigation Planning Committee, with representation from all participating municipalities. (Ref: pg 9) The permanent Committee is an outgrowth of the HMCC, and represents citizen, municipal, business, educational, volunteer and county interests through a balanced membership. The leadership of the Committee is from a Mitigation Coordinator, following the HMCC model, in conjunction with the Director of the County Emergency Management Agency.

The Committee is to oversee the progress made on the implementation of the identified action items and update the plan, as needed, to reflect changing conditions. The Committee will revise the plan by analyzing past mitigation actions, risk assessment, infrastructures and development in the county. The Committee is to serve as the focal point for coordinating the countywide mitigation efforts. The proposed Hazard Mitigation Committee will meet yearly to address all its responsibilities. The EMA director will coordinate these meetings either annually or when conditions such as a completed mitigation or new flood plain ordinances have been developed. The master copy will be kept at the Coshocton County EMA office. The committee is to serve in an advisory capacity to the Coshocton County Board of Commissioners and applicable Planning Commissions in the county.

The Committee was given a presentation on the plan to introduce the new committee members to it, which was followed by a group discussion to determine a way to analyze and review the plan. The Committee decided that constructing a survey that analyzed the critical facilities and the possible hazards that affect the community would be the best way to start reviewing the plan. The committee also reviewed the old mitigation actions and found them to be not feasible and decided to reconstruct the actions. (Ref: pg 60, end of Table 19)

After developing and analyzing all natural hazards, the committee developed the new hazard mitigation actions then prioritized each action, first according to hazard, then according to each action under that hazard. A review of other components of the plan was conducted by the Committee and changes were

presented for discussion and agreement by its members. All the information was compiled and used to update the Master Plan. These changes were tracked by comparing the original document to updated plan.

The Committee is to monitor the mitigation activities by reviewing reports from the agencies or jurisdictions implementing different mitigation actions. Participating agencies or jurisdictions can submit a semi-annual report providing mitigation activity information and their status of each activity to the Committee. The Plan Writer on the Committee enters applicable information into the Master Plan.

Evaluation of the Plan will not only include checking whether mitigation actions are implemented or not, but also assessing their degree of effectiveness. This will be done by reviewing the qualitative and quantitative benefits (or avoided losses) of the mitigation activities. These are then to be compared to the goals and objectives the Plan set out to achieve. The Committee is to also evaluate mitigation actions if they need to be discontinued, or modified in any way in light of new developments in the community. The progress is documented by the Committee and submitted to the Board of Commissioners on an annual basis.

The Plan will be submitted to FEMA every five years, as required by the Disaster Mitigation Act, 2000, or significant change to the community, including after a disaster. The updated Plan is to include any new developments (new structures, as well as other changes) in the community or special circumstances (e.g. post-disaster). Issues that come up during monitoring and evaluation that require changes in mitigation strategies and actions will be incorporated in the Plan at this stage.

### **5.3 Public Involvement**

The Committee will involve the public, which includes but is not limited to neighboring communities, agencies, businesses, academia, nonprofits, and other interested groups, during the evaluation and update of the Plan through annual public education projects, public workshops and hearings. The public will also have access to information via newsletters, mailings and the different agencies implementing the plan. The county's website (<http://www.coshocountycity.net>) can serve as a means of two-way communication by not only providing information about mitigation initiatives within the county, but also having feedback forms and other means for the public to express their views and comments. The Committee will incorporate the public comments in the next update of the plan.

## 5.4 Updating the Plan

Throughout the hazard analysis and vulnerability assessment, descriptions of missing or inadequate data indicate some areas in which the county and municipalities can improve their ability to identify vulnerable structures. As the county and municipal governments work to increase their overall technical capacity and implement their comprehensive planning goals, they will attempt also to improve their ability to respond to identified hazard vulnerability identification and other needs. In short, the county and municipalities in subsequent versions of this plan will improve upon the hazard identification and vulnerability assessment by:

- Developing construction trends in the county.
- Continuing to update the tax and GIS databases with information like addresses, foundation type, construction type, and first-floor elevations for each structure. The updated plan will be better able to identify structures in need of mitigation based on first-floor elevations.
- Increase jurisdiction participation. Develop annual meetings for the jurisdiction to provide feedback and input for the plan.

## Table 22 Record of Change

**Note** – Changes in the plan have only been recorded in this section. If the plan was updated due to formatting or rephrasing, the change was not recorded.

<b>Date</b>	<b>Initials</b>	<b>Page #</b>	<b>Paragraph</b>	<b>Reason/Comments</b>
12/2/09	JS	60-63	Table 19	Updated Ranking and Mitigation Actions
12/14/09	JS	59-63	Table 19	Some mitigation actions were changed from previous document. Previous actions were not feasible.
12/14/09	JS	33-39		Updated hazard assessment; included earthquakes, drought and class one dams
3/23/10	JS	70		Two paragraphs were added to include how the committee developed the plan
3/23/10	JS	9-10		Committee members were updated to “new”, “continuing” or “discontinued”
3/23/10	JS	10		Updated how the committee and public provided input
3/23/10	JS	60-63	Table 19	The method of ranking the mitigation actions were changed