



Birthplace of our
18th President
Ulysses S. Grant

Monroe Township, Ohio Monroe Township All Natural Hazard Mitigation Plan

Monroe Township, Ohio

Monroe Township All Natural Hazard Mitigation Plan

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Monroe Township, Ohio

Monroe Township All Natural Hazard Mitigation Plan

1. Forward

In recent years, Monroe Township has suffered damage from natural hazards. In light of the effects of these hazards, the township has committed to alleviating suffering and protecting the lives and property of its citizens by addressing mitigation, preparedness, response and recovery for natural hazards. One of the ways that Monroe Township decided to address becoming a more disaster-resistant community was to develop an All Natural Hazard Mitigation Plan. The township-wide Hazard Mitigation Plan will address natural disasters that could affect the local community, whether it is flooding, tornadoes, high winds, winter storms or some other natural disaster. By developing a mitigation plan, the Township can locate its areas of risk, assess the magnitude of the risk and develop strategies and priorities to identify projects for reducing risk.

The Township-wide All Natural Hazard Mitigation Plan will allow Monroe Township to:

- Locate their areas of risk and assess the cost and magnitude of the risk;
- Develop strategies and priorities, and identify projects for reducing risk; and
- Provide eligibility for future mitigation program funds.

Through the development of the Plan, the Township will protect lives and property and will become more disaster resistant. The mitigation planning process will compliment and expand upon existing efforts such as the comprehensive planning efforts, and organize future mitigation efforts.

2. Monroe Township Community Information

Monroe Township is located in southern Clermont County and is bordered on the east by Big Indian Creek, on the south by the Ohio River, and on the west by Boat Run. According to the 2000 Census, the population of Monroe Township is 8,236 and increasing.

2.1. History

Named for President James Monroe, the Township was first settled between 1795-96 by a Revolutionary War veteran named David Colclazer. Colclazer settled at the mouth of a small “run” that flowed into Big Indian Creek where today a bronze marker denotes the stream bearing his name.

Monroe Township has strong roots in Civil War history as two famous generals, Ulysses S. Grant and Henry Clark Corbin were born in the Township. General Grant was born in Point Pleasant in 1822 and served two terms as President. Each year on a chosen weekend at the end of April, the Annual Ulysses S. Grant birthday celebration takes place along the river. General Corbin was born in 1842 on a farm near Laurel and served as Adjutant General under three Ohio presidents.

The Township was established in June of 1825 and was formed from Ohio and Washington Townships. Rustic back roads and historic houses dating back to the 1800s still dot the Township and provide a tie to its historical roots.

2.2. Other Plans/Regulations

Monroe Township is currently working on developing a comprehensive land use plan for the Township. This land use plan will also take into account floodplain management as there is no existing floodplain management ordinance for the Township. The Clermont County Subdivision Regulations apply to Monroe Township and they contain provisions relative to floodplain management. (These regulations are discussed in detail below.) The Township also abides by the Water Management and Sediment Control Regulations of Clermont County. The purpose of these regulations is to provide for control and management of stormwater drainage, stormwater detention or retention, and soil erosion and sedimentation. (More detailed information on these regulations can be found in Section 4.4 of the plan, Landslides/Erosion.)

As stated above, the Clermont County Subdivision Regulations also apply to Monroe Township. The 2004 Subdivision Regulations are currently in draft form and could be subject to change following a public hearing. These regulations serve to guide development away from hazard areas such as floodplains and erosion prone areas, which are placed under special districts with development restrictions. In Article 5, Section 503 Sensitive Development Areas of the draft regulations, it states that if the Clermont County Planning Commission finds that lands or soils proposed to be subdivided are incapable or unsuitable for subdivision development, the Commission may require special use, design and engineering restrictions if the Planning Commission or one of its designated representatives finds that any one (1) of the following criteria apply:

1. The proposed lands or soils possess any of the attributes listed in the Sensitive Development District portion of this section.
2. The subdivision as proposed and submitted causes a hazard or abuse of such features based on the comments, conditions or exceptions offered by the County Engineer, the County Sanitary Engineer, the County General Health District, and/or the County Building Inspector.

Sensitive Development Area Criteria

A Sensitive Development Area can be defined as any land(s) or soil(s) proposed to be subdivided that, if subjected to improper use or management, is otherwise determined to be incapable or unsuitable for urban use. Sensitive Development Areas can also be considered those lands that pose special hazards to development of the environment, consisting of lands or soils of such sensitive character that they may require special use, design and engineering restrictions. Sensitive Development Areas include:

1. Tributary drainage systems – the beds and banks of perennial and intermittent streams as identified by current USGS mapping or field survey;
2. Alluvial floodplains;
3. Flood zones – land in the floodway of any existing stream, creek or river;
4. Lakes and ponds intermittently filled with water – marshes, swamps and wet spots;

5. Wetlands;
6. Both surface and subsurface quarries and gravel pits;
7. Bedrock escarpments; and
8. Steep slopes and erosion hazards.

If the Planning Commission or its designated representative finds that any of the above criteria apply to the proposed development site, the applicant shall be required to submit a statement in order to demonstrate that satisfactory efforts have been made to mitigate any special hazards posed to the site if these sensitive lands are subjected to improper use or management. The statement, if required, shall be submitted in one or more of the following forms:

1. The statement shall describe in detail the extent of encroachment on any Sensitive Development District, the extent and nature of the proposed alteration, the environmental impacts resulting from the proposed alteration, and the proposed methods of mitigation, including, but not limited to, compliance with the Clermont County Water Management and Sediment Control Regulations.
2. The applicant may submit a Geotechnical Report and/or a Wetlands Assessment/Delineation, prepared by a qualified engineer, licensed in the State of Ohio, in lieu of a development narrative.
3. If alluvial floodplains or flood zones are present on the development site, the applicant shall delineate the 100-year flood boundary and indicate the 100-year flood elevation on the plans, construction drawings and record plat.

2.3. Monroe Township Authority to Adopt Plan

In order for Monroe Township's Township-wide All Natural Hazard Mitigation Plan to be enforceable and compliant with the Disaster Mitigation Act, the Monroe Township Board of Trustees has passed a resolution to adopt the plan. A copy of the resolution of adoption can be found in Appendix A.

3. Township-wide All Natural Hazard Mitigation Planning Process

In an effort to continue to meet the mission of protecting lives, property, economic viability and quality of life for the residents of Monroe Township, township officials have opted to create a Township-wide All Natural Hazard Mitigation Plan for their community and its residents. Monroe Township sought the expertise of the engineering firm Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) to help them fulfill this task. The resulting plan will be an addendum to the Clermont County All Natural Hazard Mitigation Plan.

The approach undertaken in the creation of the All Natural Hazard Mitigation Plan for Monroe Township can be described as both comprehensive and collaborative. The comprehensive approach includes following the interim final rule guidelines enacted under the Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency (FEMA) suggested guidelines for the creation of an All Natural Hazard Mitigation Plan. All attempts were made to

coordinate efforts to meet the suggested guidelines of the Ohio Natural Hazard Mitigation Planning Guidebook.

3.1. Core Group

Obtaining support from the whole community required a comprehensive approach to preparing the Mitigation Plan. Identifying those persons, community leaders, and government agencies with the knowledge and authority to help a community organize a plan is key to the planning effort. A core group of leaders was necessary in order to give this task validity. Those that participated in the Core Group included the following:

Thomas Wildey, Director of Services
Dani Speigel, Zoning Administrator
Dennis Jowers, Monroe Township Fire Chief
Richard Saylor, Township Trustee
Tom Marck, Monroe Township Fire Department
Nancy Jolley, Recording Secretary
Ray Sebastian, Chief Building Official for Clermont County
Jim Trees, Monroe Township Maintenance

A letter was also sent out to the local business community and the New Richmond Exempted Village School District urging them to participate as well. A copy of the letter and list of recipients can be found in Appendix C. Due to the fact that there is a lack of non-profit groups within the Township, notification to those groups was not undertaken.

3.2. Public Notice

The public was notified of the planning process through several means. Public notices were posted in The Clermont Sun Newspaper prior to the kick-off meeting and the first Core Group meeting. Copies of the public notices can be found in Appendix B. The draft plan was posted on the township web site (www.monroetwp.org). The public was notified of the availability of the draft plan for review through public notices posted at the Township Fire Department and at the Township Center located on State Route 222.

3.3. Adjacent Community Notification

A letter was sent out to adjacent communities notifying them of the planning effort to develop an All Natural Hazard Mitigation Plan underway in Monroe Township. (A copy of the letter can be found in Appendix C.) The letter was sent to the following jurisdictions: Batavia Township, Franklin Township, Ohio Township, Pierce Township, Tate Township and Washington Township.

3.4. Meetings

There were four Core Group meetings throughout the planning process.

3.4.1. Meeting 1 – Determination of Hazards

At the kick-off meeting, the purpose of the All Natural Hazard Mitigation Plan process was explained to the Core Group and the Clermont County Hazard Mitigation Plan was provided for review. The Monroe Township plan will be an amendment to the Clermont County Hazard Mitigation Plan. The general process and timeline of the project was also discussed and a preliminary list of hazards was created after review of the initial hazard assessment. (Meeting summaries can be found in Appendix D.) The prioritized list of hazards as developed by the Core Group is as follows: severe storms, flooding, landslides/erosion, tornadoes, drought and earthquakes.

3.4.2. Meeting 2 – Determination of Problem Statements and Overall Goals

The second meeting was focused on the development of problem statements and on setting overall goals for the All Natural Hazard Mitigation Plan as it related to the hazards chosen for inclusion. The list of six hazards for inclusion was finalized and the Core Group then developed problem statements for each of the six hazards.

Along with the development of problem statements, the Core Group determined overall goals for each hazard. Goals are defined as general guidelines that explain what a community wants to achieve in the future, which set a community's priorities. Goals should be realistic and explain what a community wants to achieve concerning mitigation. The problem statements that were created for the hazards associated with Monroe Township are listed below.

Severe Storms

Severe storms are a primary concern for Monroe Township due to the fact that severe storms have the highest frequency of occurrence of any hazard. The Township has concerns about several aspects of severe storms, ranging from the need for additional warning sirens to the need for maintaining access throughout subdivisions.

- Additional warning sirens are needed.
- There is a need for an enhanced siren maintenance program.
- An education program is needed for “private subdivisions” that will address maintaining access throughout the subdivision.
- Power outages are often associated with severe storms and there is a lack of education and/or preparation about such storm events.
- There is a lack of an adequate stormwater drainage system and there are off-site/downstream drainage issues resulting from development. There are inadequate infrastructure sizing requirements for developments.
- All citizens need weather radios.
- High water/flood warning signs are needed at problem locations.
- Improvements are necessary for post-storm damage assessments.
- Coordination and communication with the County must be improved.

- There is a need to identify existing public shelters.

Overall goal: To address preparedness and to increase awareness of severe storms, with special emphasis on the Township's early warning system, in a manner that saves lives and reduces property damages incurred by severe storms.

Flooding

Flooding is a major concern for the Township as it is plagued with inadequate infrastructure, flash flooding areas, and outdated NFIP maps.

- The Township is plagued with inadequate infrastructure.
- There is a need to identify high-risk, flash flooding areas and to improve the warning system for such high-risk areas.
- There is a need to educate residents and leadership in flood prone areas about flood issues and post-flood procedures and increase education and reinforcement of hazardous materials in the 100-year floodplain areas.
- There is a need to identify potential utility hazards.
- NFIP maps are outdated and must be updated.
- There is a need for uniform flood depth data.
- There is a need to improve debris removal.

Overall goal: To save lives and property, reduce flood damage, and increase educational awareness of flooding in Monroe Township in a way that compliments existing efforts.

Erosion/Landslides

Landslides are a hazard of concern for Monroe Township because the topography and geology of the township create a susceptibility to landslides.

- Development regulations and enforcement on sloped property needs to be improved.
- There is a lack of knowledge of erosion/landslide sites.
- There is inadequate design and construction of structures on hillsides.
- Stop-gap repairs on road slippage/landslide problems are needed.

Overall goal: To increase awareness of hillside and streambank erosion and erosion associated with development, as well as to learn about and implement different techniques that can be used to control erosion and landslides.

Tornadoes

Tornadoes are a hazard with the potential to inflict significant damage on a community and therefore were chosen by the Core Group as a hazard to address.

- The tornado warning system needs improvement.

- An education program is needed for “private subdivisions” that will address maintaining access throughout the subdivision.
- There are power outages often associated with tornado events.
- There is a need for more public shelters/suppliers.
- There is a need to improve debris removal.
- There is a need to identify agencies and an associated need to improve response coordination with “mutual aid.”
- Weather spotting training needs improvement.

Overall goal: To save lives, property and resources by planning for and increasing awareness of the dangers of tornado events, placing special emphasis on the Township’s early warning system.

Drought

The Township’s concerns about droughts include the associated potential for wildfires and concerns over structural damage.

- There is a lack of enforcement of fire source materials (i.e. mowing) during dry periods.
- There is a lack of education to reduce damage to building foundations and other structures.
- There are dust problems emanating from construction sites.

Overall goal: To reduce the potential damage associated with droughts as well as wildfires and to increase awareness.

Earthquakes

Although the incidence of earthquakes is low, the Core Group chose to include the hazard of earthquakes to better prepare for the potentially damaging effects of earthquakes.

- There is a lack of education on the effects of earthquakes.
- There is a need to inventory high-risk structures and high risk soil areas.
- There is a lack of earthquake response materials.

Overall goal: To reduce the potential damage of earthquakes and to increase awareness.

3.4.3. Meetings 3 and 4 – Determination of Alternatives

The third meeting was designed to address how each problem statement relates to each hazard by creating possible alternatives.

Action Alternatives

Severe Storms

- Implement a township research program that will identify the need for an early warning system.
- Partner with other entities to obtain warning sirens.
- Research subdivisions and develop an ordinance for all properties in the subdivision to be under fire protection and require the formation of a homeowners association.
- Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivisions residents. Include the brochure in the newsletter as well.
- The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.
- Research into what health aids need to be available following a severe storm event in case of power loss (i.e. nebulizers, generators for breathing machines, etc.).
- Identify what preparation is needed for severe storms. Develop a volunteer list and mechanism for identifying the homes affected.
- Work to develop a public information system.
- Ensure that the Township actively participates in the County water regulation program which functions in development and regulation enforcement.
- Increase the number of storm spotters to improve advanced warning.
- Look into changing design criteria to improve drainage capabilities.
- Seek funding to purchase weather radios for all citizens.
- Inventory and identify problem locations.
- Partner with the County/State to install water depth signs in dips/swales.
- Increase post-storm communication with the County, State, IMAC, and BOA about recovery efforts and federal disaster declarations.
- Partner with the County EMA and participate in additional training in countywide 911 building initiatives and initiatives associated with the Department of Homeland Defense.
- Use GIS to identify and map the existing shelters and create an inventory of such shelters.

Flooding

- Check drainage facilities, culverts, and pipes for adequate size.
- Develop and coordinate programs to meet or exceed those at the County level.

- Have maintenance identify high-risk flash flooding areas and notify residents that they are in a high-risk area. Use County GIS system as well as existing data and pictures to identify high-risk areas.
- Improve the warning system for high-risk areas. Increase signage at high-risk areas.
- Develop and implement educational programs about flood issues and post-flood procedures as well as hazardous materials in the 100-year floodplain areas.
- Identify/inventory potential utility hazards (ground transformers, gas meters, propane tank floatability, fuel oil tanks in basements, water tank abandonment, and tower abandonment).
- Inventory storage buildings in flood areas for proper anchoring of tanks.
- Conduct hazard material training and create an inspection program.
- Update NFIP maps.
- Research the possibility of implementing a uniform/NWS depth gauge similar to New Richmond's.
- Focus on preventative maintenance practices.
- Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.
- Notify the County/State of their responsibility.

Erosion/Landslides

- The Township should aggressively pursue the development of a land use plan that will address both old and new development.
- Develop an inventory of erosion/landslide sites.
- Develop an inventory of structures on hillsides.
- Implement stop-gap repairs.

Tornadoes

- Develop plans/ideas for seeking funding for adding/maintaining additional sirens.
- Develop a siren maintenance system that will include the additional sirens.
- Research subdivisions and develop an ordinance for all properties in the subdivision to be under fire protection and require the formation of a homeowners association.
- Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivision residents. Include the brochure in the local newsletter as well.

- The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.
- Research into what health aids need to be available following a severe storm events in case of power loss.
- Identify what preparation is needed for severe storms. Develop a volunteer list and mechanism for identifying the homes affected.
- Work to develop a public information system.
- Use GIS to identify and map existing shelters and create an inventory of the existing shelters.
- Implement a training program for shelter operators.
- Seek a block grant for the construction of new shelters.
- Focus on areas of high population density and develop a response plan and “supply” list.
- Focus on preventative maintenance practices.
- Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.
- Notify the County/State of their responsibility.
- Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.
- Identify weather spotter candidates/volunteers and have the volunteers attend the weather spotter’s school.

Drought

- Increase enforcement of the mowing code.
- Examine the mowing code for the possibility of increasing the mowing frequency.
- Issue a public service announcement in the township newsletter.
- Increase education through the development of a drought procedure manual.
- Increase enforcement of dust problems from construction sites and coordinate with the County to ensure that regulations are being followed.

Earthquakes

- Educate the public by developing Public Service Announcements that can be published in brochures as well as on TV and videotape.
- Increase education through programs in schools and through public access.

- Undertaken an inventory of high-risk structures and high-risk soil areas.
- Develop earthquake response materials for the township administrator.

3.5. Matrix Development

Once the alternatives were created for each hazard, the Core Group established evaluation criteria to rank each of the alternatives. The criteria used for evaluation were the following: cost effective, technically feasible, environmentally sound, socially equitable, meets local regulations, activities reduce risk and funding available.

The evaluation criteria and the alternatives developed by the Core Group were then placed in a matrix that organized all of the alternatives (see Figure 1 on the following page). Utilizing a matrix allowed the Core Group to systematically review all of the alternatives, identifying which mitigation method(s) are appropriate based on the specified criteria. The combined results of the Core Group members were tabulated and the matrix comparison was completed, allowing Monroe Township to focus their mitigation strategies on the highest rated activities.

Monroe Township	<div> <div>Cost Effective</div> <div>Technically Feasible</div> <div>Environmentally Sound</div> <div>Socially Equitable</div> <div>Meets Local Regulations</div> <div>Activities Reduce Risk</div> <div>Funding Available</div> <div>Total</div> </div>							
Severe Storms								
No action.	0	0	0	0	0	0	0	0
Additional warning sirens are needed.								
Implement a township research program that will identify the need for an early warning system.	3	3	3	3	3	3	1	19
Partner with other entities to obtain warning sirens. The County and other townships are potential contacts.	3	3	3	3	3	3	2	20
There is a need for an enhanced siren maintenance program.								
Develop a siren maintenance program.	3	3	3	3	3	3	1	19
An education program is needed for "private subdivisions" that will address maintaining access throughout the subdivision.								
Research subdivisions and develop an ordinance for all properties in the subdivision to be under fire protection and encourage the formation of a homeowners association.	2	2	2	3	3	3	1	16
Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivision residents. Include the brochure in the local newsletter.	3	3	3	3	3	3	2	20
The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.	1	1	1	1	1	1	0	6
Power outages are often associated with severe storms and there is a lack of education and/or preparation about such storm events.								
Research into what health aids need to be available following a severe storm event in case of power loss (i.e. nebulizers, generators for breathing machines, etc.).	3	3	3	3	1	3	2	18
Identify what preparation is needed for severe storms. Develop a volunteer list and mechanism for identifying affected homes.	2	2	2	2	2	2	1	13
Work to develop a public information system.	3	3	3	3	3	3	1	19
There is a lack of an adequate storm water drainage system and there are off-site/downstream drainage issues resulting from development. There are also inadequate infrastructure sizing requirements for developments.								
Ensure that the Township actively participates in the County water regulation program which functions in development and regulation enforcement.	3	2	3	3	3	3	2	19
Increase the number of storm spotters to improve advanced warning.	3	3	3	3	3	3	2	20
Look into changing design criteria to improve drainage capabilities.	1	1	3	1	1	3	1	11
All citizens need weather radios.								
Seek funding to purchase weather radios for all citizens.	3	3	3	3	3	3	1	19
High water/flood warning signs are needed at problem locations.								
Inventory and identify problem locations.	3	3	3	3	3	3	3	21
Partner with the County/State to install water depth signs in dips/swales.	3	3	3	3	3	3	2	20
Improvements are necessary for the post-storm damage assessments.								
Increase post-storm communication with the County, State, IMAC, and BOA about recovery efforts and federal disaster declarations.	3	3	3	3	3	3	2	20
Coordination and communication with the County must be improved.								
Partner with the County EMA and participate in additional training in countywide 911 building initiatives and initiatives associated with the Department of Homeland Defense.	3	3	3	3	3	3	2	20
There is a need to identify existing public shelters.								
Use GIS to identify and map the existing shelters and create an inventory of such shelters.	3	3	3	3	3	3	3	21
Flooding								
No action.	0	0	0	0	0	0	0	0
The Township is plagued with inadequate infrastructure.								
Check drainage facilities, culverts, and pipes for adequate size.	3	2	3	3	3	3	1	18
Develop and coordinate programs to meet or exceed those at the County level.	2	2	3	3	2	3	2	17
There is a need to identify high-risk, flash flooding areas and to improve the warning system for such high-risk areas.								
Have maintenance identify high-risk flash flooding areas and notify residents that they are in a high risk area. Use the County GIS system as well as existing data and pictures to identify high risk areas.	3	2	3	3	3	3	1	18
Improve the warning system for high-risk areas. Increase signage at high-risk areas.	3	2	3	3	3	3	1	18
There is a need to educate residents and leadership in flood prone areas about flood issues and post-flood procedures and increase education and reinforcement of hazardous materials in the 100-year floodplain areas.								
Develop and implement educational programs about flood issues and post-flood procedures as well as hazardous materials in the 100-year floodplain areas.	3	3	3	3	2	3	2	19
There is a need to identify potential utility hazards.								
Identify/inventory potential utility hazards (ground transformers, gas meters, propane tank floatability, fuel oil tanks in basements, water tank abandonment, and tower abandonment).	3	2	3	3	3	3	2	19
Conduct hazard material training and create an inspection program.	3	3	3	3	3	3	2	20
NFIP maps are outdated and must be updated.								
Update NFIP maps.	3	3	3	3	3	3	3	21
There is a need for uniform flood depth data.								
Research the possibility of implementing a uniform/NWS depth gauge similar to New Richmond's.	3	3	3	3	3	3	2	20
There is a need to improve debris removal.								
Focus on preventative maintenance practices.	3	3	3	3	3	3	3	21
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.	3	3	3	3	3	3	3	21
Notify the County/State of their responsibility.	3	3	3	3	3	3	3	21
Erosion/Landslides								
No action.	0	0	0	0	0	0	0	0
Development regulations and enforcement on sloped property needs to be improved.								
The Township should aggressively pursue the development of a land use plan that will address both old and new development.	3	3	3	3	3	3	3	21
There is a lack of knowledge of erosion/landslide sites.								
Develop an inventory of erosion/landslide sites.	3	3	3	3	3	3	3	21
There is inadequate design and construction of structures on hillsides.								
Develop an inventory of structures on hillsides.	3	3	3	3	3	3	3	21
Stop-gap repairs on road slippage/landslide problems are needed.								
Implement stop-gap repairs.	3	2	3	3	3	3	1	18
Tornadoes								
No Action.	0	0	0	0	0	0	0	0
The tornado warning system needs improvement.								
Develop plans/ideas for seeking funding for adding/maintaining additional sirens. This will involve the use of new technology and research into the need for an early warning system.	3	3	3	3	3	3	1	19
Develop a siren maintenance system that will include the additional sirens.	3	3	3	3	3	3	2	20
An education program is needed for "private subdivisions" that will address maintaining access throughout the subdivision.								
Research subdivisions and develop a resolution for all properties in the subdivision to be under fire protection and require the formation of a homeowners association.	3	2	2	3	3	3	1	17
Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivision residents. Include the brochure in the local newsletter.	3	3	3	3	3	3	2	20
The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.	3	0	3	3	3	3	0	15
There are power outages often associated with tornado events.								
Research into what health aids need to be available following a severe storm event in case of power loss (i.e. nebulizers, generators for breathing machines, etc.).	3	3	3	3	2	3	2	19
Identify what preparation is needed for severe storms. Develop a volunteer list and mechanism for identifying affected homes.	3	3	3	3	2	3	1	18
Work to develop a public information system.	3	3	3	3	3	3	1	19
There is a need to identify more public shelters/supplies.								
Use GIS to identify and map the existing shelters and create an inventory of such shelters.	3	3	3	3	3	3	3	21
Implement a training program for shelter operators.	3	3	3	3	3	3	2	20
Seek a block grant for the construction of new shelters.	3	3	3	3	3	3	3	21
Focus on areas of high population density and develop a response plan and "supply" list.	3	3	3	3	3	3	2	20
There is a need to improve debris removal.								
Focus on preventative maintenance practices.	3	3	3	3	3	3	3	21
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.	3	3	3	3	3	3	3	21
Notify the County/State of their responsibility.	3	3	3	3	3	3	3	21
There is a need to identify response agencies and an associated need to improve response coordination with "mutual aid."								
Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.	3	3	3	3	3	3	3	21
Weather spotting training needs improvement.								
Identify weather spotter candidates/volunteers and have the volunteers attend the weather spotter's school.	3	3	3	3	3	3	2	20
Drought								
No action.	0	0	0	0	0	0	0	0
There is a lack of enforcement of fire source materials (i.e. mowing) during dry periods.								
Increase enforcement of the mowing code.	3	3	3	3	3	3	3	21
Examine the mowing code for the possibility of increasing the mowing frequency.	3	3	3	3	3	3	3	21
Issue a public service announcement in the township newsletter.	3	3	3	3	3	3	3	21
There is a lack of education to reduce damage to building foundations and other structures.								
Increase education through the development of a drought procedure manual.	3	3	3	3	3	3	3	21
There are dust problems emanating from construction sites.								
Increase enforcement of dust problems from construction sites and coordinate with the County to ensure that regulations are being followed.	3	3	3	3	3	3	2	20
Earthquakes								
No action.	0	0	0	0	0	0	0	0
There is a lack of education on the effects of earthquakes.								
Increase education through programs in schools and through public access.	3	3	3	3	3	3	3	21
There is a need to inventory high risk structures and identify high risk soil areas.								
Undertake an inventory of high risk structures and high risk soil areas.	3	3	3	3	3	3	2	20
There is a lack of earthquake response materials.								
Develop earthquake response materials for the township administrator.	3	3	3	3	3	3	2	20

Figure 1. Monroe Township Matrix

4. State of Natural Disasters and Hazard Assessment for Monroe Township

4.1. Initial Hazard Determination for Delhi Township

In order to properly evaluate the natural hazards that affect Monroe Township, a three-step process was utilized.

Step 1 – FMSM Engineers researched FEMA’s database to determine which hazards FEMA had documented as possible natural hazards, including future hazard threats, for the State of Ohio. Hazards listed on FEMA’s website include flooding, severe storms, tornadoes and winter storms.

Step 2 – FMSM Engineers reviewed the National Climatic Data Center (NCDC) web site, which provides historic hazard information down to the county level. The NCDC website presents each hazard and the historic information associated with it for each county, offering several hazard search parameters including those pertinent to Monroe Township.

Step 3 – In addition to the NCDC data, FMSM reviewed the Ohio Hazard Analysis and Risk Assessment, a document created in 1998 by OEMA for local and state emergency preparedness officials. The Ohio Hazard Analysis and Risk Assessment looks at both natural and non-natural hazards.

4.2. Severe Storms

Monroe Township, like most communities in Ohio, is susceptible to severe weather. The severe weather category is a “catch all” for hazards that do not meet other specific criteria, but may be associated with tornado and flood hazards. Severe thunderstorms, winter storms, high wind, ice storms, hail and lightning are all examples of hazards included in the severe weather category.

One of the biggest problems associated with severe weather is the lack of public education and awareness. Severe storms can cause damage and are often the precursor for much more severe hazards that may follow. One example is that tornadoes are sometimes directly linked with thunderstorms.

4.2.1. Severe Thunderstorms

A severe thunderstorm watch is issued by the National Weather Service when the weather conditions are such that damaging winds of 58 mph or more, or hail three-fourths of an inch in diameter or greater, is likely to develop. Citizens should locate a safe place in the home and tell family members to watch the sky and listen to the radio or television for more information. A severe thunderstorm warning is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, danger is immediate, citizens should move to a safe place, turn on a battery-operated radio or television, and wait for the “all clear” by the authorities.

Tornadoes and flash flooding are spawned by thunderstorms. When a “severe thunderstorm warning” is issued, review what actions to take under a “tornado warning” or a “flash flood warning.” When thunderstorms produce heavy rains (which can cause flash flooding), strong

winds, hail, lightning and tornadoes, people should get inside a sturdy building and stay tuned to a battery-operated radio for weather information.

Lightning is also a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed each year by lightning. The myth that lightning never strikes twice in the same place needs to be replaced by the fact that lightning can strike several times in the same place in the course of a single discharge.



Figure 2. Lightning

4.2.2. Winter Storms

The leading cause of death during winter storms is transportation accidents. Preparing your vehicle for the winter season, and knowing how to react if stranded or lost on the road are vital to safe winter driving. Another major problem is the lack of concern citizens have for extremely cold temperatures during the Ohio winters when the wind chill can dramatically affect the temperature outside, causing frostbite in a matter of minutes.

Wind Chill

Wind chill is a calculation of how cold it feels outside when the effects of temperature and wind speed are combined. A strong wind combined with a temperature just below freezing can have the same effect as a still air temperature 35°F colder.



Figure 3. Winter Storm

Winter Storm Watches and Warnings

A winter storm watch indicates that severe winter weather may affect your area. A winter storm warning indicates that severe winter weather conditions are definitely on the way. A blizzard warning signifies that large amounts of falling or blowing snow, and sustained winds or at least 3 mph are expected for several hours.

4.2.3. Severe Storm Events Specific to Monroe Township

Documented information on severe storm events is sparse for Monroe Township. The following thunderstorm and high wind events were obtained from the National Climatic Data Center and are specific to the surrounding areas outside of Monroe Township. These events are included here because events specific to Monroe Township were not documented. These events can provide a general idea as to the kind of storm events that Monroe Township has dealt with and will deal with in the future.

Thunderstorms and High Winds

Bethel 5/24/1996 – Thunderstorm winds. \$3,000 in property damages. Numerous trees were knocked down.

Amelia 6/14/1996 – Thunderstorm winds. \$5,000 in property damages. Numerous large trees downed.

Bethel 5/19/1997 – Thunderstorm winds. \$100,000 in property damages. Numerous trees downed, some falling on residences and a church.

Countywide 4/15/1999 – Thunderstorm winds. \$500,000 in property damages. Trees were downed in Amelia and a mobile home was blown over. Several other mobile homes received minor damage. Spotters in the area reported a wind gust of 61 mph. Trees were also downed in Washington Township and other locations with several reports of minor roof damage.

Amelia 6/11/1999 – Thunderstorm winds. \$16,000 in property damages. A tree fell on a mobile home, a shed was blown over and numerous trees were downed.

New Richmond 8/17/2000 – Thunderstorm winds. \$5,000 in property damages. Trees were knocked down across roads around New Richmond.

Amelia 9/23/2000 – Thunderstorm winds. \$10,000 in property damages. Thunderstorm winds knocked down trees, some of which fell on cars.

New Richmond 7/9/2003 – Thunderstorm winds. \$3,000 in property damages. Trees and power lines were downed.

Hail

Bethel 6/21/1995 – 0.75 inch hail.

Bethel 6/22/1995 – 0.75 inch hail.

Bethel 5/13/1998 – 1.00 inch hail.

Amelia 5/24/1998 – 0.75 inch hail.

Countywide 8/9/2000 – 1.00 inch hail. \$25,000 in property damages. A thunderstorm remained over the county for nearly two hours producing quarter size hail in Amelia and Batavia, nickel size in Felicity, and hail large enough to knock out the windows of a school building in Williamsburg. Trees were also knocked down in various locations across the county. Two clusters of thunderstorms caused significant damage on the 9th. During the morning hours, a large bow echo raced across the area causing widespread damage. During the afternoon and evening hours, a large cluster of storms formed causing widespread wind damage and hail along with some flooding.

Snow and Ice

There were no snow and ice storms that were specific to Monroe Township or to its surrounding communities but several events are listed below as examples of winter storms that have hit southern/southwestern Ohio.

Athens, Brown, Butler, Clermont, Clinton, Gallia, Hamilton, Highland, Jackson, Meigs, Pike, Ross, Vinton, Warren and Washington Counties 1/28/1995 – Heavy snow/ice. \$600,000 in property damages. Southwest Ohio, parts of south-central and southeast Ohio were hit by this storm. Heavy snow accumulated an average of 3 to 5 inches in a narrow band from the Cincinnati area across south-central Ohio from Waverly to Marietta. The snow fell at an inch or two an hour and a maximum snowfall of eight inches was reported in several areas in Highland County. Precipitation initially started as rain and changed to freezing rain and sleet before changing to snow. The ice accumulated about one-half inch in the Cincinnati area. The

snow/icy conditions closed many roads and caused hundreds of accidents. The ice also resulted in the John A. Roebling suspension bridge, which connects Cincinnati to northern Kentucky, to be closed for the first time ever. Some power lines were downed by the ice/snow.

Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Highland, Hocking, Licking, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto and Warren Counties 1/6/1996 – Winter Storm. \$14.3 million in property damages. The Blizzard of '96 developed near the Gulf Coast and moved up the East Coast. This massive system produced the greatest total and 24-hour snowfall at the Greater Cincinnati/Northern Kentucky Airport. This one storm brought 14.3 inches of snowfall to the airport which normally receives 23 inches for an entire season. The heaviest snow fell near the Ohio River in the extreme south. The worst blizzard conditions occurred over West Central areas as dry and powdery snow was blown around by high winds causing whiteouts. Some areas had more than 30 continuous hours of snowfall, and many people in Southern Ohio felt that this was the worst winter storm since the Blizzard of '78.

Adams, Brown, Butler, Clermont, Clinton, Hamilton, Highland, Pike, Ross, Scioto and Warren Counties 2/16/2003 – Winter Storm. \$1.5 million in property damages. Warm moist air on southerly winds was brought to the Ohio River Valley during the early morning hours. Cold air in place at the surface allowed most of this precipitation to fall as freezing rain. Most areas received a quarter to a half-inch of ice accumulation.

4.2.4. Infrastructure and Critical Facilities

Due to the non site-specific nature of this hazard, the assessment of the impacts of severe storms on infrastructure and critical facilities will be of a general kind. Critical facilities can be impacted most directly by severe storms through power outages. Those critical facilities for which power is crucial (i.e. hospitals, nursing homes, etc.) will be greatly impacted by severe storms and precautions must be taken for the provision of emergency generators, etc. In terms of potential impacts on infrastructure and utilities, roads may be flooded by heavy rains associated with severe storms. (Refer to Section 4.3, Figure 11 for the systemic flooding locations throughout the Township.) Utility outages can be attributed to heavy winds and freezing temperatures. Additional efforts and analyses will be undertaken for additional plan updates.

4.2.5. Monroe Township Severe Weather Mitigation Efforts

Monroe Township has implemented an early warning system that consists of only two sirens to serve the entire township. The Township would like to increase the capacity of the system by adding additional sirens. With the exception of the implementation of these two sirens, the Township has undertaken no further mitigation efforts.

4.2.6. Current Development Trends

Due to the non site-specific nature of this hazard, current development trends have no significant effects. Monroe Township is primarily rural in nature, but there are areas all throughout the Township that are experiencing growth and others with potential to develop in the near future. A number of farms have recently been sold for residential development throughout the Township. There is also a multi-family housing project slated for development along the northern boundary of the Township. In these areas, the potential for impacts due to the hazard of severe storms is increased due to an increased and more concentrated population

and increased utilities and infrastructure. In the areas where future development is slated to occur, developers should give greater consideration to the importance of road design to maximize accessibility during a winter storm event. More effort should be placed on maintenance of utility areas to reduce the number of power outages from fallen trees and/or branches due to the accumulation of ice and/or snow and high winds. New development should also allow for the provision of basement areas to serve as storm shelters and should assess wind-load standards.

4.2.7. Hazard Assessment and Vulnerability Analyses / Potential Dollars Lost

Because severe storms are random in nature and the identified hazard area for a severe storm event could include the entire Township, the Core Group has chosen to look at historic events to determine Monroe Township's susceptibility. According to the National Climatic Data Center (NCDC), there have been 128 thunderstorm and high wind events in Clermont County between 1950 and September of 2004, with losses totaling over \$3.5 million in property damages. In terms of lightning events, there were six between 1950 and September of 2004 adding up to \$61,000 in property damages. In terms of hail events, there were 40 during that time period, totaling over \$2.6 million dollars in property damages. There were 24 snow and ice events to hit Clermont County between 1950 and September of 2004, with losses totaling close to \$18 million in property damages. (Appendix E contains complete event listings for each severe storm subcategory.)

In terms of future occurrences, because there were no severe storm events listed specific to Monroe Township, the number of events to hit the County as a whole will be used to gage the potential for future occurrences. For thunderstorm and high wind events, the recurrence interval would be approximately 1 year for those events of a magnitude significant enough to cause severe damage, on the order of \$100,000 or more in property damage. In terms of lightning events, there are only six events to consider for the County over the past 50+years, with four of the six occurring in 1996 and none on record before that. The data available is thus not adequate enough to calculate an accurate recurrence interval; however, based on an average of the events listed, a recurrence interval of 1 year would be predicted. In terms of hail events, those events with significant damages either to crops or property, with hail above 1.00 inch in size, have a recurrence interval of approximately 3 years based on the historical data for the County. In terms of snow and ice events, those classified as winter storms have been assigned a recurrence interval of 1.5 years.

4.2.8. Matrix Results for Severe Storms

Monroe Township		Total
Severe Storms		
No action.		0
Additional warning sirens are needed.		
Implement a township research program that will identify the need for an early warning system.		19
Partner with other entities to obtain warning sirens. The County and other townships are potential contacts.		20
There is a need for an enhanced siren maintenance program.		
Develop a siren maintenance program.		19
An education program is needed for "private subdivisions" that will address maintaining access throughout the subdivision.		
Research subdivisions and develop an ordinance for all properties in the subdivision to be under fire protection and encourage the formation of a homeowners association.		16
Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivision residents. Include the brochure in the local newsletter.		20
The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.		6
Power outages are often associated with severe storms and there is a lack of education and/or preparation about such storm events.		
Research into what health aids need to be available following a severe storm event in case of power loss (i.e. nebulizers, generators for breathing machines, etc.).		18
Identify what preparation is needed for severe storms.		
Develop a volunteer list and mechanism for identifying affected homes.		13
Work to develop a public information system.		19
There is a lack of an adequate storm water drainage system and there are off-site/downstream drainage issues resulting from development. There are also inadequate infrastructure sizing requirements for developments.		
Ensure that the Township actively participates in the County water regulation program which functions in development and regulation enforcement.		19
Increase the number of storm spotters to improve advanced warning.		20
Look into changing design criteria to improve drainage capabilities.		11
All citizens need weather radios.		
Seek funding to purchase weather radios for all citizens.		19
High water/flood warning signs are needed at problem locations.		
Inventory and identify problem locations.		21
Partner with the County/State to install water depth signs in dips/swales.		20
Improvements are necessary for the post-storm damage assessments.		
Increase post-storm communication with the County, State, IMAC, and BOA about recovery efforts and federal disaster declarations.		20

Figure 4. Matrix Results for Severe Storms

The matrix results show the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activities from the matrix evaluation are highlighted in the matrix above in pink. The two items highlighted in yellow are those items that did not come out as highly rated within the matrix but which the Core Group felt should be highly rated.

- ***Implement a township research program that will identify the need for an early warning system.***
- ***Seek funding to purchase weather radios for all citizens.***
- ***Inventory and identify problem locations.***
- ***Use GIS to identify and map the existing shelters and create an inventory of such shelters.***

4.3. Flooding

Monroe Township has concerns related to both river and flash flooding. The Ohio River forms the southern boundary of the township, while Back Run, Twelvemile Creek, and Ferguson Run wind through the township, often causing flash flooding (see Figure 6).

Documented information on historical flooding occurrences is sparse. The Department of Services was contacted for historical flooding information as was the local fire department, however, there was no written documentation on any past flooding events. The following flood events were obtained from the National Climatic Data Center and are specific to the surrounding areas outside of Monroe Township. These events were included here because events specific to Monroe Township were not documented (see Table 1). These events can provide a general idea as to the kind of flood events that Monroe Township has dealt with and will deal with in the future. More detailed descriptions of each event follow the table.

Table 1. Local Flood Events

Location	Date	Type	Death	Injury	Property Damage
Countywide	8/16/93	Flash Flood	0	0	\$500,000
Countywide	8/9/1995	Flash Flood	0	0	\$5,000
Countywide	9/9/1995	Flash Flood	0	0	\$5,000
Adams, Brown, Clermont, Hamilton and Scioto Counties	3/02/1997	Flood	0	0	\$15 million
Countywide	1/3/2000	Flood	0	0	\$50,000
Bethel	7/4/2000	Flood	0	0	\$5,000

Event 1: Thunderstorm rains of 1-3 inches in less than 2 hours produced flooding of streets, streams, and basements. A nine-year old boy received serious head injuries from being hit by a falling tree as he sat in his parents' car in the driveway of their Monroe Township home. The tree had been struck by lightning.

Event 2: Between 2 and 3 inches of rain fell in less than 2 hours on saturated ground causing flooding of streets, streams, and some basements. High water covered U.S. 52 for a short time.

Event 3: Between 2 and 3 inches of rain fell in less than 2 hours on saturated ground causing flooding of streets, streams and basements. U.S. 52 was covered with high water for a short time.

Event 4: Heavy rainfall occurred across Southern Ohio and Northern Kentucky on the 1st and 2nd of March, with areas along the Ohio River receiving up to 12 inches of rainfall. The water rose rapidly, reaching a crest of 59.8 feet in Portsmouth at 10:00 PM on the 4th where the flood stage is 50.0 feet. About 30 miles east of Cincinnati at the Meldahl Dam, where the flood stage is 51.0 feet, the river crested at 61.3 feet at 7:00 PM on the 6th. In Cincinnati, the river crested at 64.7 feet at 11:00 PM on the 5th. Many towns were flooded from Portsmouth to Cincinnati and thousands of people were evacuated from their homes for several days.

Event 5: Heavy rainfall over several hours caused flooding of roads and homes across the county.

Event 6: Heavy rainfall caused flooded roads between Bethel and Williamsburg.

Flash Flooding

Flash floods are the number one weather related killer in the United States, with around 140 deaths recorded each year. Flash floods can happen anywhere at anytime. Monroe Township's concern for flash flooding is two-fold: there is a lack of warning time to let residents know that a flash flood is imminent; and undersized infrastructure may be unable to handle a specific storm event. Much of the flash flooding within the Township occurs in the northern section of the Township, in areas adjacent to Back Run, Ulrey Run and Twelvemile Creek among others (see Figure 9).

River Flooding

Major flooding along the Ohio River at the southern portion of the township is a serious concern. Data was obtained from the National Weather Service Advance Hydrologic Prediction Service on the top ten historical crests for the Ohio River at the Meldahl Dam, located about 30 miles east of Cincinnati, the closest gaging station to the Township. The flood stage of the Ohio River at the Meldahl Dam is 51 feet. The top ten historical crests are as follows:

- | | |
|---------------------------|----------------------------|
| 1. 76.00 ft on 01/26/1937 | 6. 52.00 ft on 01/31/1994 |
| 2. 63.20 ft on 03/13/1964 | 7. 51.80 ft on 02/21/2000 |
| 3. 62.50 ft on 03/05/1997 | 8. 51.77 ft on 12/12/1972 |
| 4. 53.80 ft on 01/03/1991 | 9. 51.30 ft on 01/09/2004 |
| 5. 53.73 ft on 01/24/1996 | 10. 48.70 ft on 02/26/2003 |

In terms of impacts, the National Weather Service lists the following:

- At 76.0 feet: This is the flood of record which was set in January 1937. At stages near 76 feet, the entire floodplain is inundated, much of U.S. 52 is flooded, and many low-lying residences and businesses must be evacuated.
- At 63.0 feet: The Village of Neville becomes inaccessible and much of Moscow becomes flooded. Large amounts of property damage can be expected and

evacuations of homes and businesses become widespread. U.S. 52 is flooded in long stretches.

- At 61.0 feet: The entire Village of Neville in Clermont County becomes flooded. Much of U.S. 52 is impassible for long stretches and significant lowland and backwater flooding can be expected along the river.
- At 58.0 feet: Much of the Village of Neville floods with evacuations of homes and businesses becoming necessary. Significant backwater flooding occurs along creeks and streams emptying into the Ohio River. U.S. 52 becomes flooded in many low areas.
- At 55.0 feet: The Village of Neville begins to experience lowland flooding while backwater flooding along creeks and streams results in lowland flooding along the river. U.S. 52 becomes cut off in southern Clermont County at Bear Creek and Maple Creek near Neville.
- At 53.5 feet: U.S. 52 and State Route 232 near Point Pleasant become covered with water while backwater flooding near the river worsens.
- At 53.0 feet: Water rises over U.S. 52 below the locks and backwater flooding begins along several creeks and streams in Clermont County and Bracken and Pendleton Counties in Kentucky.
- At 51.0 feet: Lowland and backwater flooding occurs in southern Clermont and Brown Counties in Ohio and Bracken County in Kentucky.

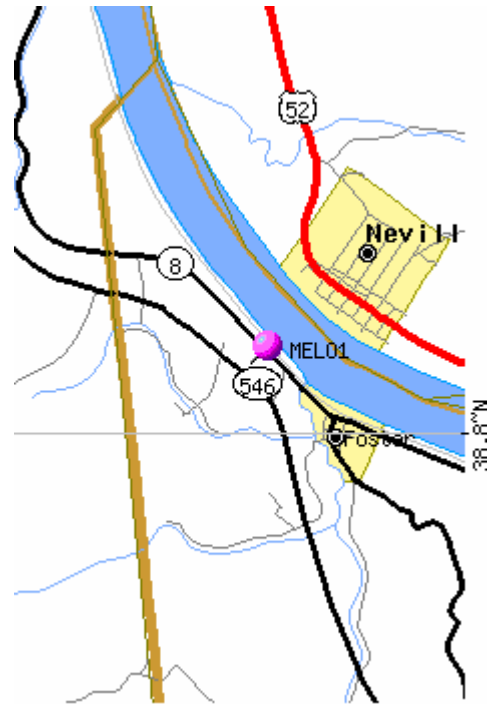


Figure 5. Location of Meldahl Dam



Figure 6. Monroe Township 100-year Floodplains

4.3.1. Repetitive Loss

Repetitive loss is a term that is usually associated with the National Flood Insurance Program (NFIP). For Flood Mitigation Assistance (FMA) program purposes, a repetitive loss structure is one that is covered by a flood insurance contract under the NFIP that has suffered flood damage on two or more occasions over a 10-year period, ending on the date when a second claim is made, in which the cost to repair the flood damage, on average, equals or exceeds 25% of the market value of the structure at the time of each flood loss event. A repetitive loss structure is important to the NFIP, since structures that flood frequently put a strain on the flood insurance fund. Repetitive loss structures are also important to a community because of the disruption and threat to residents' lives that are caused by the continual flooding. According to FEMA records, there is one repetitive loss structure in Monroe Township (see Figure 7 on the following page). This structure is located within the boundaries of the 100-year floodplain in the southern portion of the Township.

4.3.2. Structure Inventory in Monroe Township

There are 37 structures in Monroe Township that are considered to be at-risk (see Figures 8-10). This information was obtained from the Ohio Department of Natural Resources, Division of Water, Floodplain Geographical Information Management System (GIMS) Project. Based on comparing the structure locations with the township zoning map, coupled with input from the Core Group, a breakdown of the structures into land use categories was possible.

Residential:	1
Commercial/Industrial:	11
Agricultural:	25

Median values for each of the land use categories above were obtained from the Clermont County Auditor, Real Estate Administration Division. According to the information obtained, the median value for residential structures is \$67,960; the median value for commercial/industrial structures is \$89,650; and the median value for agricultural structures is \$84,855. This information was taken to calculate the potential dollars lost for at-risk structures within the 100-year floodplain. Table 2 below presents the results of those calculations.

Table 2. Potential Dollars Lost Calculations

Median Value of Res. Structures	Median Value of Comm./Ind. Structures	Median Value of Ag. Structures	Potential Res. Dollars Lost	Potential Comm./Ind. Dollars Lost	Potential Ag. Dollars Lost
\$67,960	\$89,650	\$84,855	\$67,960	\$986,150	\$2,121,375

The total potential dollars lost for residential, commercial/industrial and agricultural structures combined is calculated to be over \$3.1 million.

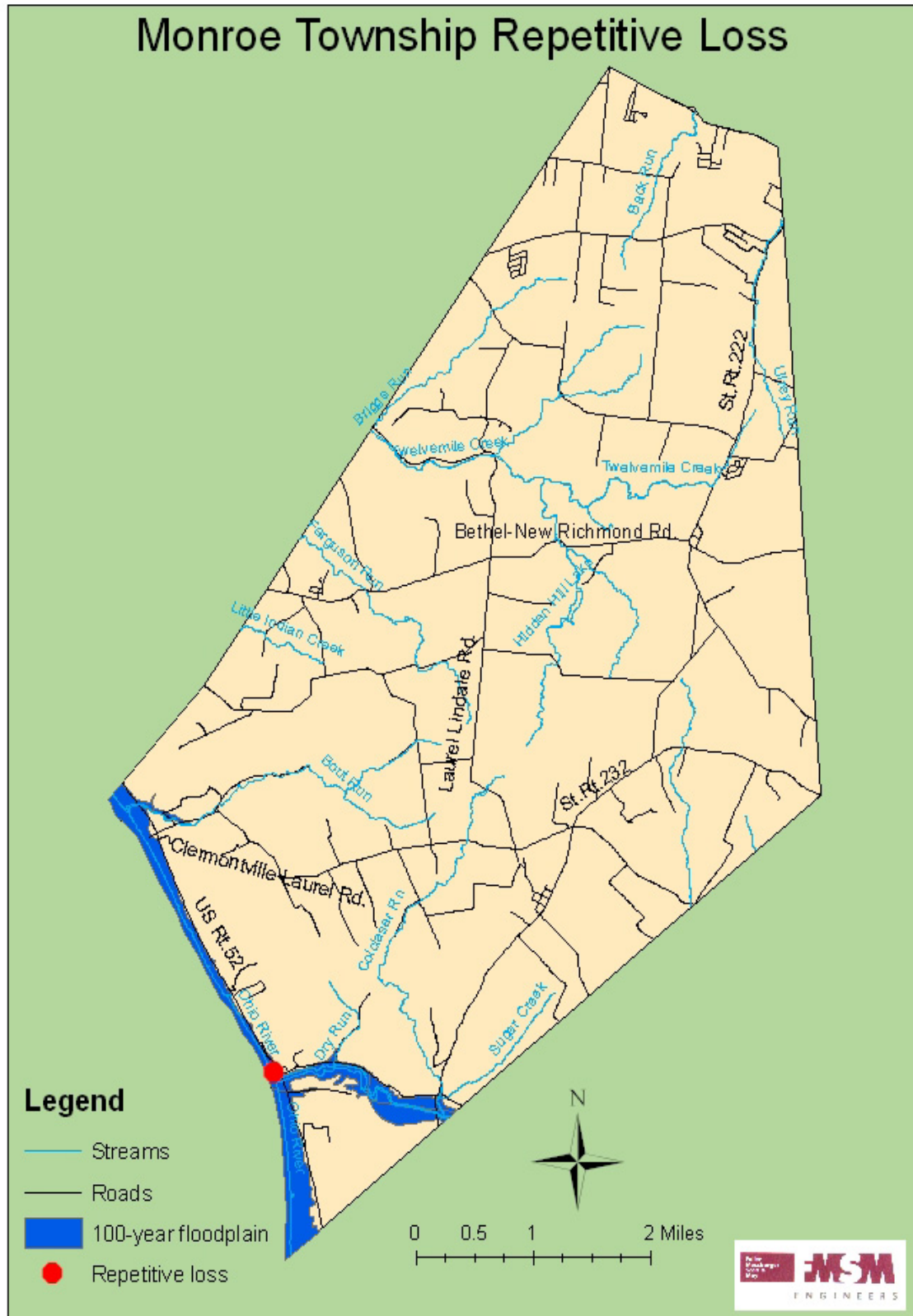


Figure 7. Repetitive loss in Monroe Township



Figure 8. Monroe Township At-Risk Structures



Figure 9. At-Risk Structures (Northern Half of Township)



Figure 10. At-Risk Structures (Southern Half of Township)

4.3.3. Infrastructure and Critical Facilities

Monroe Township Public Works, Clermont County Public Safety Services and the Clermont County Engineer were contacted in terms of systemic flooding issues on roads throughout the Township. The County Engineer is not aware of any specific flooding problems that occur within Monroe Township. Monroe Township Public Works provided a map that identified the locations of systemic flooding in the Township. The locations were digitized into GIS and are illustrated in Figure 11. As is evident from the figure, there are several locations throughout the Township that are plagued by systemic flooding problems. Only two of the locations identified on the map are associated with annual flooding events and those are nearest the 100-year floodplains along the Ohio River. The rest of the identified systemic flooding locations are problematic due to flash flooding and proximity to streams. These locations of systemic flooding problems have been considered in regards to the locations of critical facilities. The only critical facility located near the identified areas of systemic flooding is the fire station located on St. Rt. 222, with systemic flooding locations on either side of the facility.

Table 3 provides the locations of critical facilities shown in Figure 11, which illustrates critical facilities within Monroe Township with respect to floodplains and areas of systemic flooding.

Table 3. Monroe Township Critical Facilities

Facility	Address
Monroe Elementary School	2117 Laurel-Lindale Rd.
Headstart	2179 East Ohio Pike
Monroe Township Fire Dept.	1963 Laurel-Lindale Rd.
Clermont County Sheriff	2772 St. Rt. 222
Tate Monroe Water Treatment Plant	Idlett Hill Road



4.3.4. Monroe Township Flood Mitigation Efforts

There are currently no flood mitigation efforts underway, nor have there been any in the recent past.

4.3.5. Current Development Trends

Monroe Township does not have a floodplain management ordinance; however under the Clermont County Subdivision Regulations, there are provisions that serve to monitor development in and near floodplains. The 2004 Subdivision Regulations are currently in draft form. These regulations serve to guide development away from hazard areas such as floodplains and erosion prone areas, which are placed under special districts with development restrictions. In Article 5, Section 503 Sensitive Development Areas of the draft regulations, it states that if the Clermont County Planning Commission finds that lands or soils proposed to be subdivided are incapable or unsuitable for subdivision development, the Commission may require special use, design and engineering restrictions if the Planning Commission or one of its designated representatives finds that any one (1) of the following criteria apply:

1. The proposed lands or soils possess any of the attributes listed in the Sensitive Development District portion of this section.
2. The subdivision as proposed and submitted causes a hazard or abuse of such features based on the comments, conditions or exceptions offered by the County Engineer, the County Sanitary Engineer, the County General Health Director, and/or the County Building Inspector.

Sensitive Development Area Criteria

A Sensitive Development Area can be defined as any land(s) or soil(s) proposed to be subdivided that, if subjected to improper use or management, is otherwise determined to be incapable or unsuitable of urban use. Sensitive Development Areas can also be considered those lands that pose special hazards to development of the environment, consisting of lands or soils of such sensitive character that they may require special use, design and engineering restrictions. The lands and soils included under the Sensitive Development designation that are most relevant to the flooding hazard are as follows:

1. Alluvial floodplains – soil types AdC, Ee, Gn, Hu, Lg, Ln, Mh, Ne, Rh, Sh, and St. (See Figure 12 which depicts the areas of the Township with these soil types.)
2. Flood zones – land in the floodway or any existing stream, creek, or river as identified by any one or more of the following studies (see Figure 4 which depicts the 100-year floodplains for Monroe Township):
 - A. Federal Emergency Management Agency's Flood Hazard Boundary Maps, County of Clermont, Ohio – Unincorporated Areas.
 - B. Flood Plain Information, Ohio River Clermont County, Ohio, U.S. Army Corps of Engineers, 1968.
 - C. Flood Plain Information Study, Little Miami River, Ohio, U.S. Army Corps of Engineers, 1966.

If the Planning Commission finds that the above criteria apply to the proposed development site, the applicant shall be required to submit a statement in order to demonstrate that satisfactory efforts have been made to mitigate any special hazards posed to the site if these sensitive lands are subjected to improper use or management. For sites with alluvial floodplains and flood zones, the statement must include the delineation of the 100-year flood boundary and indication of the 100-year flood elevation on the plans, construction drawings, and record plat.

In terms of current development trends, there are no specific areas where more new development is occurring than others; development is occurring all throughout the Township. A number of farms have recently been sold for residential development throughout the Townships. The private drives associated with development are a good indicator of where development is occurring. After assessing the locations of the new private drives off of U.S. Rt. 52, there are several located within or adjacent to the 100-year floodplain along the Ohio River which forms the southern boundary of the Township. Because the Township does not have a floodplain management ordinance, these developments could be at-risk for future flood events. A multi-family housing project is slated for development along the northern boundary of the Township. This multi-family project is situated away from any flood-risk areas, including systemic flooding and 100-year flooding.



Figure 12. Alluvial floodplains in Monroe Township as Defined by the Clermont County Subdivision Regulations

4.3.6. Hazard Assessment and Vulnerability Analyses / Potential Dollars Lost

Monroe Township is susceptible to both river and flash flooding. The Ohio River forms the southern boundary of the township. Flash flooding occurs in the northern half of the township where Back Run, Twelvemile Creek, Ulrey Run and Ferguson Run cause systemic flooding problems (see Figure 11). Clermont County has experienced 67 flood events between 1950 and September of 2004, 23 of which were flash floods. (Appendix F contains a complete listing of flood events.) Documentation of events specific to Monroe Township is not available; therefore, the countywide information has been used as a reference base for past events and an indicator of future events.

Figure 6 depicts the 100-year floodplain. The areas within the floodplain depicted in this figure are areas with a 1% chance of flood occurrence. The following table illustrates the probability of occurrence for several types of floods that the Township may experience, in addition to the 100-year flood. The probability of occurrence is expressed as the percent chance that a flood of a specific magnitude will occur in any given year.

Table 4. Flood Probability of Occurrence

Flood Return Intervals	Chance of Occurrence in Any Given Year
10-Year	10%
50-Year	2%
100-Year	1%
500-Year	0.2%

In terms of potential dollars lost, there are 37 at-risk structures within the Township boundaries, the majority of these are agricultural structures. Using median value figures provided by the Clermont County Auditor's office, the total potential dollars lost as it relates to residential at-risk structures is over \$3,000,000.00 (see Table 2).

4.3.7. Matrix Results

Monroe Township		Total
Flooding		
No action.		0
The Township is plagued with inadequate infrastructure.		
Check drainage facilities, culverts, and pipes for adequate size.		18
Develop and coordinate programs to meet or exceed those at the County level.		17
There is a need to identify high-risk, flash flooding areas and to improve the warning system for such high-risk areas.		
Have maintenance identify high-risk flash flooding areas and notify residents that they are in a high risk area. Use the County GIS system as well as existing data and pictures to identify high risk areas.		18
Improve the warning system for high-risk areas. Increase signage at high-risk areas.		18
There is a need to educate residents and leadership in flood prone areas about flood issues and post-flood procedures and increase education and reinforcement of hazardous materials in the 100-year floodplain areas.		
Develop and implement educational programs about flood issues and post-flood procedures as well as hazardous materials in the 100-year floodplain areas.		19
There is a need to identify potential utility hazards.		
Identify/inventory potential utility hazards (ground transformers, gas meters, propane tank floatability, fuel oil tanks in basements, water tank abandonment, and tower abandonment).		19
Conduct hazard material training and create an inspection program.		19
NFIP maps are outdated and must be updated.		
Update NFIP maps.		21
There is a need for uniform flood depth data.		
Research the possibility of implementing a uniform/NWS depth gauge similar to New Richmond's.		20
There is a need to improve debris removal.		
Focus on preventative maintenance practices.		21
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.		21
Notify the County/State of their responsibility.		21

Figure 13. Matrix Results for Flooding

The matrix shows the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activities from the matrix evaluation are highlighted in the matrix above in pink.

- **Update NFIP maps.**
- **Focus on preventative maintenance practices in regards to debris removal.**
- **Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.**
- **Notify the County/State of their responsibility in regards to debris removal.**

Property Acquisition Action Item

In addition to the items above, the Township has developed an action item dealing with property acquisition relative to flood risks. Investigate property acquisition programs for the repetitive loss property and the at-risk structures located along the southern boundary of the Township. If property acquisition is deemed necessary by the Township through their assessments, these properties will be acquired with grant money and converted to an acceptable use, such as parks or recreational areas.

4.4. Landslides / Erosion

A landslide can be a wide range of ground or soil movements (creeps, rock falls, deep failure of slopes, slumps and shallow debris flows) that can happen in an instant or over several weeks, months, or even years. Landslides occur all over the United States and present a significant problem in several Ohio regions. A map of landslide prone areas in Ohio can be seen in Figure 14.

The most common types of landslide events in Clermont County are rotational slumps, earth flows, and rock falls. Rotational slumps produce the largest movement of earth in Ohio. They are characterized by a large mass of weakened rock or sediment moving along a curved slip plane. An example of a typical slump is depicted in Figure 15.

An earth flow involves a smaller mass, and is more common. Earth flows entail jumbled masses of rock or sediment, usually unconsolidated glacial sediment, moving down a slope, forming odd topographical features. Rock falls are described as blocks of bedrock becoming detached and tumbling down cliffs or steep slopes.

There are several indicators for landslide prone areas including tilted or bending trees, displaced fences, poles, or walls, a concentration of stones at

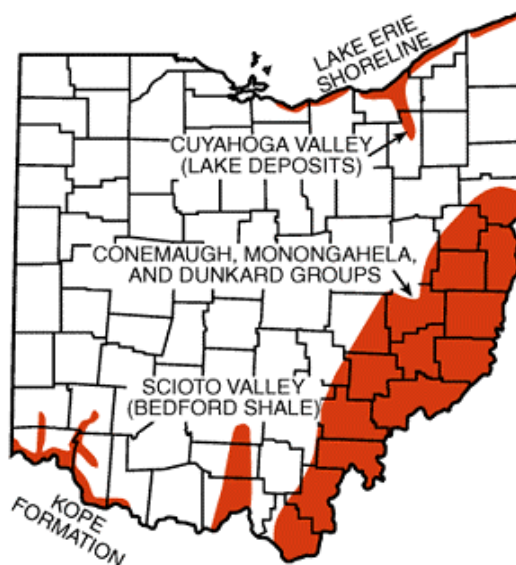


Figure 14. Landslide Prone Areas

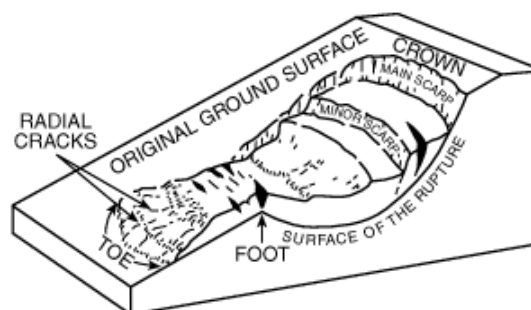


Figure 15. Rotational Slump

the toe of a slope, irregularly shaped mounds or ridges, step-like ground and water seeps. There are two elements that come together to cause landslides – existing geologic conditions combined with a trigger will set a landslide in motion.

4.4.1. Geologic Conditions of Monroe Township (Clermont County)

The geology of Clermont County and greater Cincinnati was formed primarily by three separate glacial events. Each time a glacier advanced, it left a clear and identifiable mark behind that included large deposits of sand, silt, clay and other unconsolidated glacial sediment. This type of sediment is prone to instability that can lead to landslide events. Glaciers are also largely responsible for the unique cliffs and slopes that are prevalent throughout Clermont County, and may contribute to impending landslides. Landslides can be primarily attributed to the mix of sediment and colluvial matter that overlays the bedrock in Kope Formations, as shown in Figure 14.

Another cause for earth movements in the County is the disintegration and failure of shale beds, caused by any number of reasons. These conditions combine to create a unique and starkly beautiful landscape. Unfortunately, these areas are susceptible to landslide hazards unless mitigation actions are taken. (Figure 16.)



Figure 16. Landslide Damage

4.4.2. Triggers and Catalysts of Landslide Events

There are several sets of circumstances or individual events that can lead to a landslide, most of which are directly caused by alterations made to the terrain by humans. One trigger that can cause a landslide is an activity vibration. A vibration can be anything from human induced blasting, to construction, or even heavy traffic. Slope modification is another reason landslides occur. Over-steepening a slope, adding weight to the top of a slope, removing part of the toe of a slope and constructing an embankment or fill on a slope are all possible causes for landslides.

Vegetation that exists on slopes is important in adding stability to loose soil and rocks and absorbing excess water on the slope. If removed, the slope may weaken and fail, resulting in a landslide.

Naturally recurring phenomenon might cause landslides. Large amounts of water or snowmelt can saturate the slope to the point of failure. The saturated slope could develop into a debris or mud flow. Uncontrolled runoff can lead to erosion, which can add to slope instability. Vibrations resulting from earthquakes can cause landslides, although no landslide instances involving earthquakes have ever been documented in Ohio, but the possibility remains. Though some of these catalysts cannot be foreseen, many landslides can be prevented.

4.4.3. Preventive Measures and Precautions

Many landslide hazards can be preempted by good geologic investigations and engineering practices, and effective enforcement of land-use management regulations. Avoiding the triggers of landslides and being aware of landslide indicators are the simplest ways to avert landslide hazards. Preventing unnecessary alterations of the slope, avoiding vibrations and leaving vegetation on slopes are all practical and common sense ways to avert landslides. Regulating building construction in questionable areas is another practical way to avoid a landslide catastrophe.

Measures that are more assertive can also be considered. Excavating some of the upper slope or placing fill on the toe of the slope may indeed prevent a landslide. Improving drainage on a slope can remove stress caused by excess moisture, thereby reducing the potential for landslides. Restraining the slope by the use of cribbing, piling or retaining walls may also prevent landslides or minimize damage if one does occur. These mitigation measures should be weighed with geologic, hydraulic and economic attributes before choosing the most suitable avenue of prevention.

4.4.4. Landslide Events in Monroe Township

The Clermont County Engineer and Monroe Township Public Works were contacted to obtain information on past landslide events and associated damages. The County Engineer maintains a list of current and past slides. The County Engineer's office reported that there have been two landslide events specific to Monroe Township. The first was a slide on Clermontville-Laurel Road which occurred in 2001. This slide was 400 feet in length and was repaired during the summer of 2003. The cost to repair the slide damage was \$459,000. The repair entailed drilling shafts into the bedrock. During the summer of 2004, there was a culvert collapse/slide on Clermontville-Laurel Road in close proximity to the slide that occurred in 2001. This culvert collapse will be repaired this spring (2005) by the County Engineer's office and the costs for repair have been estimated at \$150,000. In addition to the events that occurred on Clermontville-Laurel Road, other landslide areas as identified by the Township include Dry Run and State Route 232 and along Twelve Mile Creek.

4.4.5. Erosion

Erosion, the detachment of particles of soil and surficial sediments and rocks, is a natural process. The process becomes a problem when human activities like construction cause it to occur much faster than under natural conditions.

Urbanization increases erosion rates by replacing vegetation with impervious surfaces like pavement and rooftops. Surfaces such as these do not allow any infiltration of the rainwater, causing water to run off across these surfaces in large sheets that often flow at a high velocity. When this increased surface flow reaches a stream, the result is often increased erosion rates.



Figure 17. Streambank Erosion

The important roles that vegetation plays in providing protective cover and soil erosion protection are eliminated when it is removed or replaced by impervious surfaces. Plants function in intercepting rainwater before it hits the ground, breaking the impact of a raindrop before it hits the soil, thus reducing its ability to erode. Plants slow down the water as it flows over the land (runoff) and allows much of the rain to soak into the ground. Plant roots also have an important function in holding the soil in position and preventing it from being washed away.

Streambank erosion, the direct removal of streambanks and beds by flowing water, often becomes problematic with increased development in an area. Streambank erosion is exacerbated by the lack of riparian zone vegetation. The riparian zone can be defined as the area of land adjacent to and including the stream.

The impacts of erosion can be severe. In addition to the loss of land due to streambank erosion, dramatic changes in the course of a river or stream can result. These changes in the stream's course can result in a loss of aquatic habitats. Deposition of the eroded soil can lead to sedimentation in reservoirs and downstream areas. Water quality is reduced due to the high sediment loads, which also impacts aquatic habitats. Damage to public utilities (roads, bridges and dams) can also result due to increased stream flow and stream velocity as well as sedimentation. There are often high maintenance costs associated with trying to prevent or control erosion.

4.4.6. Erosion Problem Sites

The documented erosion problem sites coincide with the two landslide locations on Clermontville-Laurel Road. Additional erosion problem sites identified by the Township include Altman Road, Dry Run Road, East Boat Run Road, and St. Rt. 232 near Big Indian Road. In addition, there are erosion problems along Boat Run Creek, Twelve Mile Creek, Colclaser Run and Ulrey Run Creek. These problem areas are due to flooding and can be illustrated in Figure 11 which depicts systemic flooding locations (all except for the Colclaser Run location have been identified on the map).

4.4.7. Infrastructure and Critical Facilities

In terms of landslides, road closures are a concern associated with landslides and are most prone to occur in the areas within the Township that have been identified as high-risk areas. These high-risk areas are composed of steep slopes and erosion/landslide prone soils which are illustrated in Figure 18 on the following page. Roads and other infrastructure located in these red areas are at high risk for landslide potential. Clermontville-Laurel Road has experienced past landslides and is located within the dense area of red in the southern part of the Township. U.S. Rt. 52 is also located within this dense area of red indicating steep slopes and high-risk soils. Careful analysis should be employed when siting any structures, especially critical facilities within the high-risk areas. Erosion problem areas are also found along Clermontville-Laurel Road, therefore precautions should be taken in the maintenance of the section of the road that is located within the identified hazard areas. Additional erosion problem sites include Altman Road, Dry Run Road, East Boat Run Road, and St. Rt. 232 near Big Indian Road. These general locations have been highlighted on Figure 18. Other erosion problems areas are located along Boat Run Creek, Twelve Mile Creek, Colclaser Run and Ulrey Run Creek. These locations coincide with the systemic flooding locations identified in Figure 11 (with the exception of Colclaser Run).

In terms of critical facilities, only the Tate Monroe Water Treatment Plant is located within an area denoted as being high-risk due to steep slopes and high-risk soils. Precautions should be taken to ensure that the plant is safe from landslides and soil movement. The remaining critical facilities, the fire stations and schools, are not located within a high-risk area as denoted on Figure 18.

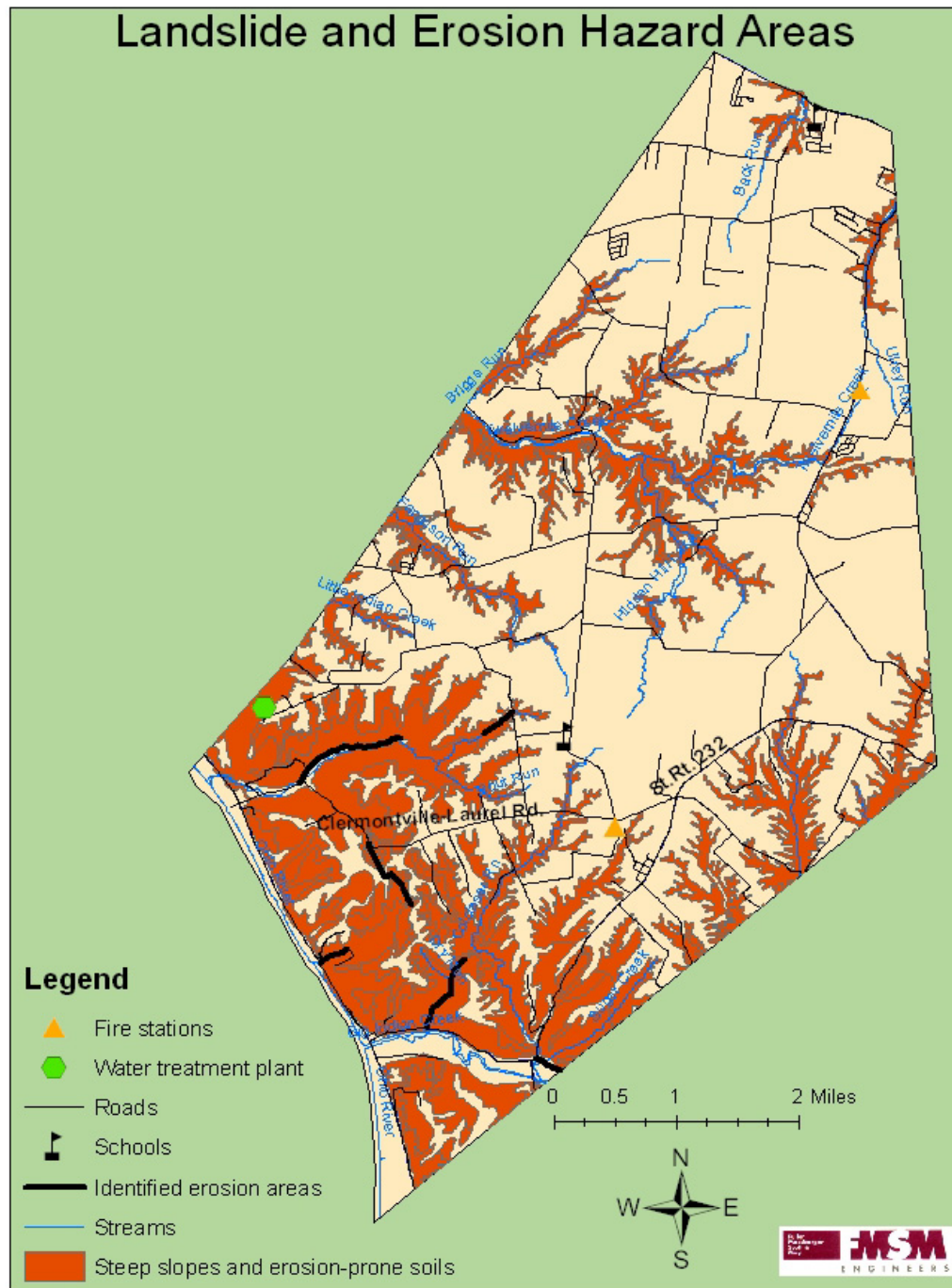


Figure 18. Steep Slopes and Erosion Hazard Areas With Respect to Critical Facilities

4.4.8. Monroe Township Landslide / Erosion Mitigation Efforts

There are currently no landslide or erosion mitigation efforts underway in Monroe Township, nor have there been any in the recent past. With regard to landslides, the efforts have been reactionary in nature rather than preventative. The Township could consider working to restrict development in high-risk areas through the creation of a hillside development overlay zone by partnering with the Clermont County Planning Department.

4.4.9. Current Development Trends

In terms of current development trends, there are no specific areas where more new development is occurring than others; development is occurring all throughout the Township. A number of farms have recently been sold for residential development throughout the Township. There is a multi-family housing project slated for development along the northern boundary of the Township.

When considering where the new development is going in and has been put in recently, several of the newly developed areas appear to have been located within areas at high risk for landslides and erosion due to steep slopes and high-risk soils. For example, residential developments have been put in on new roads coming off of Clermontville-Laurel Rd. in a large area of high-risk due to steep slopes and high risk soils (see Figure 18). The multi-family housing that is slated to be constructed along the northern boundary of the township should be located outside of the high-risk areas that exist along portions of that northern boundary. As future development continues, it may become necessary for the Township to consider implementing a hillside overlay district that would help to guide development away from high-risk areas. For example, in areas not well-suited for development, the overlay could require that those areas be retained in open space or recreational use, and it could also prohibit development on slopes greater than 20%.

In terms of erosion control measures that Clermont County has implemented, in 1990, the County implemented Water Management and Sediment Control (WMSC) Regulations. These regulations serve to aid in the minimization of erosion occurrences associated with development. These regulations apply to all non-farm earth disturbing activities performed on the unincorporated lands of the County. As stated in the scope of the regulations, the purpose of these regulations is to provide for control and management of stormwater drainage, stormwater detention or retention, and soil erosion and sedimentation. These Water Management and Sediment Control Regulations shall apply to all earth disturbing activities involving land grading, excavation, cut, fill or other alteration on land used or being developed for non-agricultural commercial, industrial, residential, or other non-agricultural purposes, and shall establish criteria for the determination of the acceptability of such stormwater management and sediment and erosion control practices.

These regulations separate earth disturbing activities into four types of development: site development for subdivisions, commercial developments, and industrial developments; site development for single commercial or industrial buildings, including additions and accessory buildings; construction of residential homes that are located in approved subdivisions and residential homes on single lots of any size; and cut fill or grading. These four types of development require different forms of documentation prior to the commencement of development activities.

1. Site development for subdivisions, commercial developments, and industrial developments. (These types of developments require a Site Development Permit prior to the issuance of a Building Permit.)
2. Site development for single commercial or industrial buildings, including additions and accessory buildings. (These buildings will require a Water Management and Sediment Control plan whose complexity is dependent on the requirements and characteristics of the building site and proposed development.)
3. Construction of residential homes that are located in approved subdivisions and residential homes on single lots of any size, including additions and accessory buildings. (An approved subdivision is one that has received prior formal approval from the Clermont County Planning Commission.)
4. Cut, fill or grading. (Permits are required in certain cases.)

Under the general requirements of Article 6.0 entitled Erosion and Sediment Control Measures, the regulations state that an erosion and sediment control system shall be designed and implemented both during construction and after the development is completed. The development of an erosion and sediment control system consists of providing two separate systems, the erosion control system and the sediment control system. The focus here will be placed on the erosion control system.

The erosion control system is to be installed to prevent the detachment of soil particles from the soil surface and to minimize soil particle movement into the stormwater runoff system leaving the development or project area for the purpose of limiting the pollution of waters of the State and adjacent property.

Article 6.0 also calls for an erosion and sediment control plan. The regulations spell out specific criteria for the erosion and sediment control plan. The specified criteria that will be discussed here include the stabilization of denuded areas and soil stockpiles and cut and fill slopes. Under the stabilization of denuded areas, the regulations require that the clearing of vegetation, cutting and filling, excavation or other earth disturbing activities shall be done so that erosion will be minimized. Permanent or temporary soil stabilization must be applied to any denuded areas within 15 days after final grade is reached on any portion of the development or project area. Permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized and protected from erosion. Under cut and fill slopes, the regulations state that cut and fill slopes must be designed and constructed in a manner which will minimize erosion. Consideration must be given to the length and steepness of the slope, soil type, upslope drainage, subsurface conditions, and other applicable factors.

Monroe Township also has to abide by the Clermont County Subdivision Regulations which contain provisions related to erosion. These regulations serve to guide development away from hazard areas such as floodplains and erosion prone areas, which are placed under special districts with development restrictions. The lands and soils included under the Sensitive Development designation that are most relevant to the landslide/erosion hazard are as follows:

- Steep slopes and erosion hazards – sand gravel soil types in excess of eighteen (18), silt soils in excess of twelve (12); and clay soils in excess of twelve (12) percent slope; defined as soil types: AdC, CcD2, CkD3, EaD2, EaE2, EaF2, EbD2, EbE2, EbG2, EcE3, EdG3,

FaE2, FaG2, GpE2, HkD2, HkF2, HiG3, RkE2, SeD2, and WrD2. (See Figure 18 for the areas within the Township that fall within this district category.)

If the Planning Commission finds that the above criteria apply to the proposed development site, the applicant shall be required to submit a statement in order to demonstrate that satisfactory efforts have been made to mitigate any special hazards posed to site if these sensitive lands are subjected to improper use or management. The statement, if required, shall describe in detail the extent of encroachment on any Sensitive Development District, the extent and nature of the proposed alteration, the environmental impacts resulting from the proposed alteration, and the proposed methods of mitigation, including, but not limited to, compliance with the Clermont County Water Management and Sediment Control Regulations.

4.4.10. Hazard Assessment and Vulnerability Analysis / Potential Dollars Lost

In terms of landslides and erosion, Figure 18 illustrates the areas within the Township that are most at-risk due to steep slopes and high risk soils. There have been two landslide events documented specifically for Monroe Township and these events had repair costs of \$459,000 and \$150,000. To provide an estimate for the potential dollars lost associated with future events, the two past event repair costs have been averaged, yielding an estimate of \$304,500.

Clermontville-Laurel Road is at risk high risk for landslide potential based on the fact that two landslide events specific to the Township occurred on that road. U.S. Rt. 52 is another major transportation artery that is located within a risk zone with respect to steep slopes and high risk soils. In terms of critical facilities, the Tate Monroe Water Treatment Plant is located within an area denoted as being high-risk due to steep slopes and high-risk soils.

There are several preventative measures and precautions that can be employed to reduce landslide hazards. Many landslide hazards can be prevented by sound geologic investigations and engineering practices, as well as effective enforcement of land use management regulations. Avoiding the triggers of landslides and being aware of landslide indicators are the simplest ways to avoid landslide hazards. Preventing unnecessary alterations of the slopes, avoiding vibrations and leaving vegetation on slopes are all practical ways to avoid landslides. Regulating building construction in questionable areas is another practical way to avoid a landslide.

Measures that are more aggressive can also be considered. Excavating some of the upper slope or placing fill on the toe of the slope may prevent a landslide. Improving drainage on a slope can remove stress caused by excess moisture, thereby reducing the potential for landslides. Restraining the slope by the use of cribbing, piling or retaining walls may also prevent landslides or minimize damage if a landslide does occur.

According to the Hazard Analysis and Risk Assessment published by the Ohio Emergency Management Agency, Clermont County has an average of 15 annual landslides. In terms of recurrence intervals for landslides for Monroe Township, the records for past landslides indicates that there have been two specific to Monroe Township. These events occurred in 2001 and 2004, yielding a recurrence interval of 3 years.

4.4.11. Matrix Results

Monroe Township		Total
Erosion/Landslides		
No action.		0
Development regulations and enforcement on sloped property needs to be improved.		
The Township should aggressively pursue the development of a land use plan that will address both old and new development.		21
There is a lack of knowledge of erosion/landslide sites.		
Develop an inventory of erosion/landslide sites.		21
There is inadequate design and construction of structures on hillsides.		
Develop an inventory of structures on hillsides.		21
Stop-gap repairs on road slippage/landslide problems are needed.		
Implement stop-gap repairs.		18

Figure 19. Erosion Events for Erosion/Landslides

The above matrix results show the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activities from the matrix evaluation are highlighted in the matrix above in pink.

- ***The Township should aggressively pursue the development of a land use plan that will address both old and new development.***
- ***Develop and inventory of erosion/landslide sites.***
- ***Develop an inventory of structures on hillsides.***

4.5. Tornadoes

Tornados are considered the most violent atmospheric phenomenon on the face of the earth, producing winds estimated at 300 mph in large tornados. Tornados are formed from energy released during a thunderstorm, but account for only a tiny fraction of the overall energy generated by a thunderstorm. What makes them particularly dangerous is the small area of concentrated energy, sometimes only a hundred yards across. Although the number of tornadoes does not rank high compared to some other states, the State of Ohio averages around 14 tornadoes a year. Ohio's peak tornado season runs from April through July, with most

tornados occurring between 2-10 PM. Although June has been the month with the most tornado occurrences, many of the State's major tornado outbreaks have taken place in April and May. However, history has shown that tornadoes can occur during any month of the year and at any time of the day or night. Many of these tornadoes are weak (F0 or F1 on the Fujita Scale), but Ohio has been struck by some of the most destructive (F5) tornadoes ever, including the April 3, 1974 tornado that devastated Xenia, killing over 30 people and destroying 2,000 buildings.



Figure 20. Tornado Funnel Cloud

Clermont County (Monroe Township), which lies in the far southwest corner of Ohio, is within the area referred to as the Ohio Valley “Tornado Alley.” Because of the geography and prevailing weather patterns in the spring and summer, storm systems produce tornadoes across the Ohio Valley several times each year.

The Fujita scale in Table 5 is the mechanism used to determine the potential type of tornado that may have affected a particular community. It is based on velocity of wind and the type of damage the tornado caused.

Table 5. Fujita Scale for Tornadoes

Scale Value	Wind	Damage
F-0 Weak	Wind: 40-72 mph	Light Damage: Some chimneys damaged, twigs and branches broken off trees, shallow-rooted trees pushed over, signboards damaged, some windows broken.
F-1 Weak	Wind: 73-112 mph	Moderate Damage: Surface of roofs peeled off, mobile homes pushed off foundations or overturned, outbuildings demolished, moving autos pushed off the roads, trees snapped or broken; beginning of hurricane speed winds.
F-2 Strong	Wind: 113-157 mph	Considerable Damage: Roofs torn off frame houses, mobile homes demolished, frame houses with weak foundations lifted and moved, large trees snapped or uprooted, light-object missiles generated.
F-3 Strong	Wind: 158-206 mph	Severe Damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted, heavy cars lifted off the ground and thrown, weak pavement blown off the roads.
F-4 Violent	Wind: 207-260 mph	Devastating Damage: Well-constructed houses leveled, structures with weak foundations blown off the distance, cars thrown and disintegrated, trees in forest uprooted and carried some distance away.
F-5 Violent	Wind: 261-318 mph	Incredible Damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate, automobile-sized missiles fly through the air in excess of 300 feet, trees debarked, incredible phenomena will occur.

Tornado Path Map

Figure 21 illustrates the location of the only tornado touchdown on record within the Township boundaries.

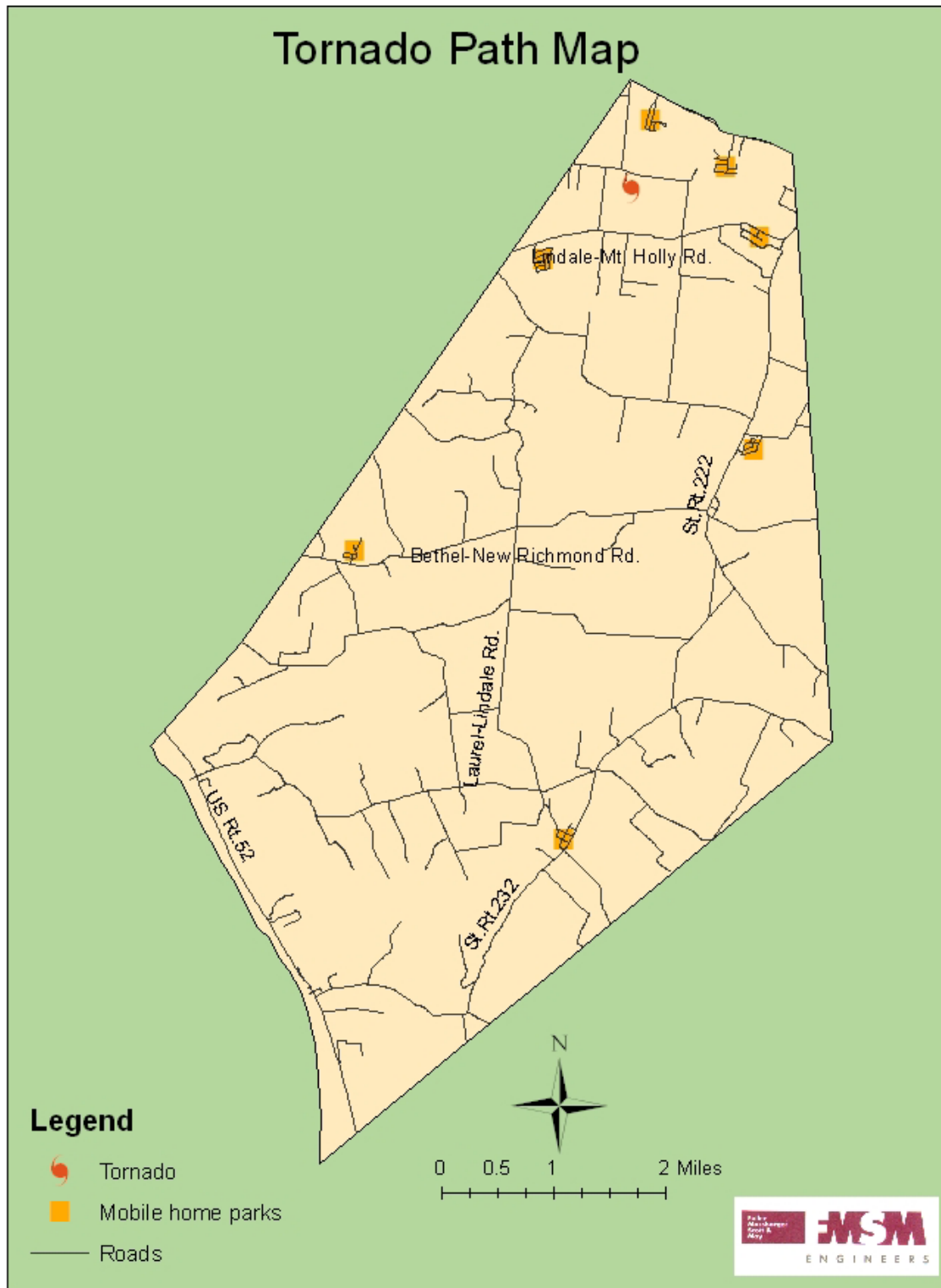


Figure 21. Monroe Township Tornado Path Map

4.5.1. Historic Tornado Events

The only tornado on record for Monroe Township struck in April of 1953. It was an F1 in magnitude, leaving a path of destruction 2 miles long and 33 yards wide, resulting in \$25,000 in property damages. The table below illustrates the tornado events listed for Clermont County:

Table 6. County-Wide Tornado Events

Location or County	Date	Magnitude	Death	Injury	Property Damage	Crop Damage
1 Clermont	04/15/1953	F1	0	0	25K	0
2 Clermont	04/23/1968	F4	1	29	2.5M	0
3 Clermont	08/09/1969	F3	0	7	250K	0
4 Clermont	06/24/1976	F0	0	0	250K	0
5 Clermont	06/12/1978	F0	0	0	25K	0
6 Clermont	06/12/1978	F1	0	0	25K	0
7 Clermont	04/08/1980	F1	0	2	250K	0
8 Clermont	06/02/1990	F2	0	0	250K	0
9 Neville	08/05/1995	F1	0	0	30K	0
10 Neville	05/08/1996	F0	0	0	30K	0
11 Moscow	07/02/1997	F3	0	0	2.0M	0
12 Loveland	08/24/1999	F0	0	0	25K	0
Totals			1	38	5.660M	0

4.5.2. Infrastructure and Critical Facilities

Due to the non site-specific nature of this hazard, the assessment of the impacts of tornadoes on infrastructure and critical facilities will be of a general nature. Critical facilities can be impacted most directly by tornadoes through physical destruction and power outages. Those critical facilities for which power is crucial (i.e., hospitals, nursing homes, etc.) have the potential to be greatly impacted by tornadoes, so precautions must be taken for the provision of emergency generators, etc. Provisions should also be taken to ensure that a tornado shelter is present within the critical facilities and that proper building materials have been utilized to withstand heavy winds.

In terms of infrastructure, the impacts are more indirect. Debris can block roads, making them near impassible. Tornadoes may have a direct impact on infrastructure through the exertion of physical damage to structures such as bridges. Additional efforts and analyses will be undertaken on the effects of tornadoes on infrastructure and critical facilities for inclusion in future plan updates.

4.5.3. Monroe Township Mitigation Efforts

The Township has implemented an early warning system that consists of two sirens to serve the entire township. The sirens were implemented approximately 25 years ago and may need to be assessed in terms of current condition. Only one of the sirens is currently functional. The Township would like to increase the capacity of the system by adding additional sirens. With the exception of the implementation of these two sirens, the Township has taken no further mitigation actions with regard to tornadoes.

4.5.4. Current Development Trends

The Township is experiencing an increase in residential development all throughout the Township due to the conversion of farmland to residential development including subdivisions. There is also a multi-family housing development slated to be developed along the northern boundary of the Township. In the areas that are experiencing growth, developers should give greater consideration to the importance of assessing wind-load standards and in providing basements as part of the design of the homes. Maintenance of utility areas to reduce the number of power outages from fallen trees and/or branches due to high winds is also important.

There are seven existing mobile home parks throughout the Township which have specific regulations regarding the siting of such homes (see Figure 21). According to the Monroe Township Zoning Resolution, Article 7 – Agricultural and Residential Districts there are additional requirements for permanently sited manufactured homes. The resolution text states that “the structure shall be installed upon and properly attached to a foundation system that provides adequate support of the structure’s vertical and horizontal loads.”

4.5.5. Hazard Assessment and Vulnerability Analysis / Potential Dollars Lost

Based on the knowledge that tornadoes are a random event and that the identified hazard area can include the entire Township, the Core Group has decided to look at tornadoes as a hazard of chance. The best way to deal with a random hazard event is to look at historical information and try to be as prepared as possible. The Core Group realized that tornadoes are usually accompanied by other natural hazards when they affect a community, as they are typically coupled by high winds, thunderstorms, lightning and possible flash floods. Therefore, preparation for these associated events is also a necessity.

According to the 2000 Census, there are 2,992 total housing units in Monroe Township and according to the Clermont County Auditor, the median value for residential units is \$67,690 (2,500 of the total housing units are owner-occupied). Two cost estimates are provided for potential dollars lost due to a future tornado event. The first estimate was calculated with the assumption that 0.1% of the housing stock (or 3 houses) would be totally devastated by a tornado event. Under this scenario, there would be over \$200,000 in damages. The second estimate was calculated with the assumption that 1% of the housing stock (or 30 homes) would be totally devastated by a tornado event. Under this scenario, there would be over \$2.0 million in damages.

There are currently seven mobile home parks within the Township’s boundaries (see Figure 21). These are the structures most vulnerable to a tornado event. The regulations within the zoning resolution regarding the installation and attachment of such structures to a foundation system have been implemented as a preventative measure.

In terms of recurrence intervals, there has only been one tornado to strike Monroe Township and that event occurred in 1953. Therefore, in determining a recurrence interval for tornadoes, the event history of the County as a whole will be taken into consideration. For F1 tornadoes, those characterized as weak with moderate damage (i.e., surface of roofs being peeled off, mobile homes being pushed off foundations, etc.), the recurrence interval is approximately 14 years. For F3 tornadoes, those characterized as strong with severe damage (i.e., roofs and some walls torn off well-constructed homes, trees uprooted, cars lifted off the ground and thrown) the recurrence interval is approximately 28 years.

4.5.6. Matrix Results

Monroe Township		Total
Tornadoes		
No Action.		0
The tornado warning system needs improvement.		
Develop plans/ideas for seeking funding for adding/maintaining additional sirens. This will involve the use of new technology and research into the need for an early warning system.		19
Develop a siren maintenance system that will include the additional sirens.		20
An education program is needed for "private subdivisions" that will address maintaining access throughout the subdivision.		
Research subdivisions and develop a resolution for all properties in the subdivision to be under fire protection and require the formation of a homeowners association.		17
Develop an emergency preparedness brochure for fire, snow, flooding and tornadoes that the EMT can place on the doors of subdivision residents. Include the brochure in the local newsletter.		20
The State Board of Health should seek to develop the same access requirements for mobile homes as other private residences.		15
There are power outages often associated with tornado events.		
Research into what health aids need to be available following a severe storm event in case of power loss (i.e. nebulizers, generators for breathing machines, etc.).		19
Identify what preparation is needed for severe storms. Develop a volunteer list and mechanism for identifying affected homes.		18
Work to develop a public information system.		19
There is a need to identify more public shelters/supplies.		
Use GIS to identify and map the existing shelters and create an inventory of such shelters.		21
Implement a training program for shelter operators.		20
Seek a block grant for the construction of new shelters.		21
Focus on areas of high population density and develop a response plan and "supply" list.		20
There is a need to improve debris removal.		
Focus on preventative maintenance practices.		21
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.		21
Notify the County/State of their responsibility.		21
There is a need to identify response agencies and an associated need to improve response coordination with "mutual aid."		
Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.		21
Weather spotting training needs improvement.		
Identify weather spotter candidates/volunteers and have the volunteers attend the weather spotter's school.		20

Figure 22. Matrix Results for Tornadoes

The matrix results above show the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activities from the matrix evaluation are highlighted in the matrix above in pink. The item highlighted in yellow is an item that did not come out as highly rated within the matrix but which the Core Group felt should be highly rated.

- ***Develop plans/ideas for seeking funding for adding/maintaining additional sirens. This will involve the use of new technology and research into the need for an early warning system.***
- ***Use GIS to identify and map the existing shelters and create an inventory of such shelters.***
- ***Seek a block grant for the construction of new shelters.***
- ***Focus on preventative maintenance practices in regards to debris removal.***
- ***Identify/inventory problem areas that are responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.***
- ***Notify the County/State of their responsibility in regards to debris removal.***
- ***Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.***

4.6. Drought

A drought is a period of abnormally dry weather that persists long enough to produce a serious hydrologic imbalance (i.e., crop damage, water supply shortage, etc.). The severity of the drought depends upon the degree of moisture deficiency, and the duration and the size of the affected area. Common to all droughts is the fact that they originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time, a few weeks or a couple of months, the drought is considered to be short-term. If the weather or atmospheric circulation pattern becomes well established and the precipitation deficits last for several months to several years, the drought is considered to be long-term.



Figure 23. Cornfield Affected by Drought

Although Ohio's droughts usually occur in the summer, they could continue through the year. Winter droughts also occur if frozen ground prohibits the recharging of groundwater or if water supplies are already reduced.

The more common summer droughts, usually accompanied by extreme heat, can lead to outages of electric power due to increased use of air conditioners accompanied by a high demand for water. Seasonal droughts may also adversely affect farm produce costs. The mid-

western “Dust Bowl” drought of the 1930s cost the State \$250 million in current dollars. Losses can be reduced by adequate mitigation and preparedness actions.

In the National Water Summary dated 1988-1989, USGS stated that:

“The drought of 1930-1936 was the most severe recorded in Ohio. Precipitation totals for 1930 and 1934 were the smallest since the earliest statewide records in 1883. Since 1930, droughts in Ohio have occurred about every 10 years, with an apparent random variation in duration and severity. A short but severe drought occurred in 1988.”

4.6.1. Recent Droughts in Monroe Township (Clermont County)

Clermont County has experienced droughts most recently in 1999 and 2002. The Clermont County Soil and Water Conservation District applied for drought emergency funding each year with the United States Department of Agriculture (USDA) Farm Service Agency. The 1999 drought conditions began in early spring and continued into early July. Rainfall was widely scattered. The 2002 drought conditions began in early summer and continued across the Ohio Valley through August, with most areas receiving well below normal rainfall for the month. Most counties in southwestern Ohio were declared Federal Disaster areas by the USDA.

Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is used by many Federal agencies and States to evaluate the current impact of limited rainfall. The PDSI is calculated based on precipitation and temperature data, as well as the local Available Water Content (AWC) of the soil. The numerical index varies from 4.0, which indicates extremely wet conditions, to -4.0, which indicates extreme drought conditions. The following table defines the range of PDSI values.

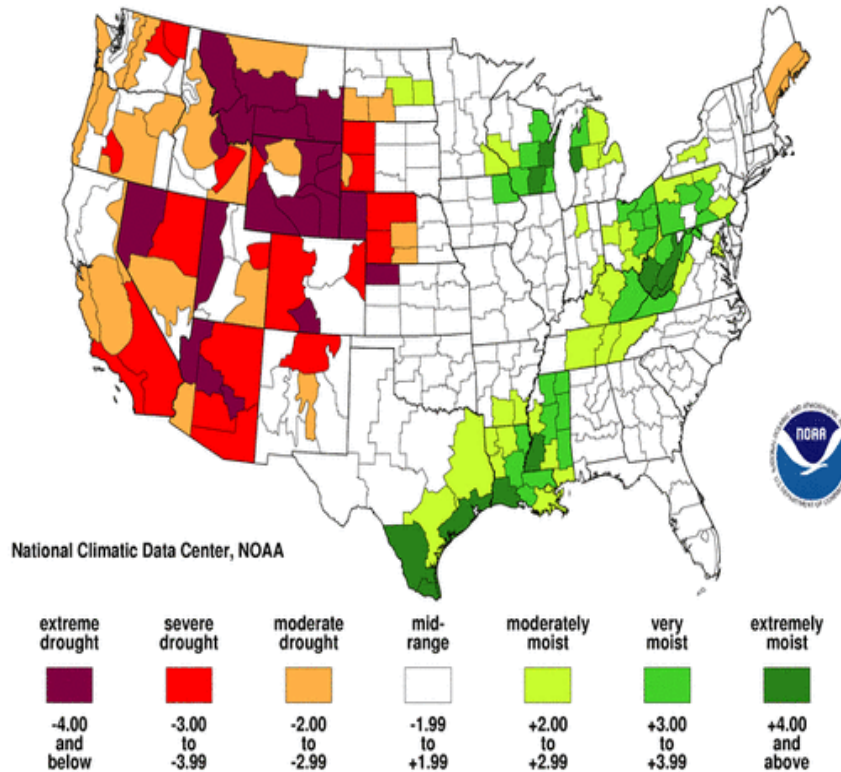
The data is typically plotted on a map in varying shades to reflect the variation of the severity of the conditions (see Figure 24). The red shading on these maps denotes drought conditions while the green shading indicates wet conditions.

Table 7. Palmer Drought Classifications

Palmer Classifications	
4.0 or more	Extremely wet
3.0 to 3.99	Very wet
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.9 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

Palmer Drought Index Long-Term (Meteorological) Conditions

June 2004



Source: <http://lwf.ncdc.noaa.gov/oa/climate/research/prelim/drought/pdiimage.html>

Figure 24. Palmer Drought Index

4.6.2. Infrastructure and Critical Facilities

Drought does not affect infrastructure but could have impacts on critical facilities by potentially restricting the availability of water. Additional efforts and analyses on the effects of drought on infrastructure and critical facilities will be undertaken for future plan updates.

4.6.3. Monroe Township Drought Mitigation Efforts

There are no drought mitigation efforts currently underway, nor have any occurred in the recent past.

4.6.4. Current Development Trends

Due to the fact that a drought is a non site-specific hazard, current development trends have no effect on the consequences of a drought except in areas that are experiencing more development and thus putting a greater strain on the existing water supply. There are areas all throughout the Township which are experiencing new residential development and these areas should be taken into account in terms of drought preparedness planning. The conversion of land in the Township from farms to residential subdivisions could potentially mean that a greater

quantity of water will be needed for consumption, thus putting a potential strain on the water system in periods of drought. The water for the entire Township comes from the Tate Monroe Water Wells, located in the floodplain along the U.S. Rt. 52 along the southern edge of the Township. A drought procedure manual could be a mitigation action to consider so that steps can be taken in case of a long-term drought which could have effects on the capability of the wells to produce water.

4.6.5. Hazard Assessment and Vulnerability Assessment / Potential Dollars Lost

Due to the non site-specific nature of this hazard, the best way to deal with preparing for future events is to consider historical occurrences. Monroe Township has only experienced two drought events during the time period from 1950 to June of 2004. Both drought events had no monetary damages associated with them, as reported by the National Climatic Data Center.

In terms of a recurrence interval for droughts in Monroe Township, the statewide information on drought events was taken into consideration due to the fact that there were only 2 drought events recorded for Clermont County. According to the National Climatic Data Center, there have been 19 drought events recorded for the state from 1950 to September of 2004. Because 14 of the drought events were listed in 1999, the recurrence interval for drought is about 1.6 years for the State of Ohio as a whole (see Appendix G for statewide drought information).

Damage from droughts is very sporadic and not very well documented. Damage estimates for property and crop damage were not included for the drought events on the National Climatic Data Center website, therefore no potential dollars lost calculations have been considered at this time. A large portion of the Township is rural in nature, therefore the impacts to farms in terms of damage losses could be significant if a drought of considerable duration were to occur.

4.6.6. Matrix Results for Drought

Monroe Township		Total
Drought		
No action.		0
There is a lack of enforcement of fire source materials (i.e. mowing) during dry periods.		
Increase enforcement of the mowing code.		21
Examine the mowing code for the possibility of increasing the mowing frequency.		21
Issue a public service announcement in the township newsletter.		21
There is a lack of education to reduce damage to building foundations and other structures.		
Increase education through the development of a drought procedure manual.		21
There are dust problems emanating from construction sites.		
Increase enforcement of dust problems from construction sites and coordinate with the County to ensure that regulations are being followed.		20

Figure 25. Matrix Results for Drought

The matrix results show the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activities from the matrix evaluation are highlighted in the matrix above in pink.

- ***Increase enforcement of the mowing code.***
- ***Examine the mowing code for the possibility of increasing the mowing frequency.***
- ***Issue a public service announcement in the Township newsletter.***
- ***Increase education through the development of a drought procedure manual.***

4.7. Earthquakes

Monroe Township and Clermont County could be impacted by two separate geological faults that could potentially cause an earthquake. In general, earthquakes with epicenters in Ohio occur along pre-existing zones of weakness in Precambrian rocks. The Cincinnati Arch is one such pre-existing zone and last contributed to an earthquake felt in Clermont County in 1875. This event caused damage in western Ohio, and affected a total area estimated at over 40,000 square miles. Walls were cracked and chimneys were toppled in Sidney and Urbana. Ohio is located on the periphery of the New Madrid Fault Line, which extends from Missouri and Illinois into Arkansas. The figure above illustrates where the fault lines are located within the State of Ohio as well as where the tectonic zones¹ are located.

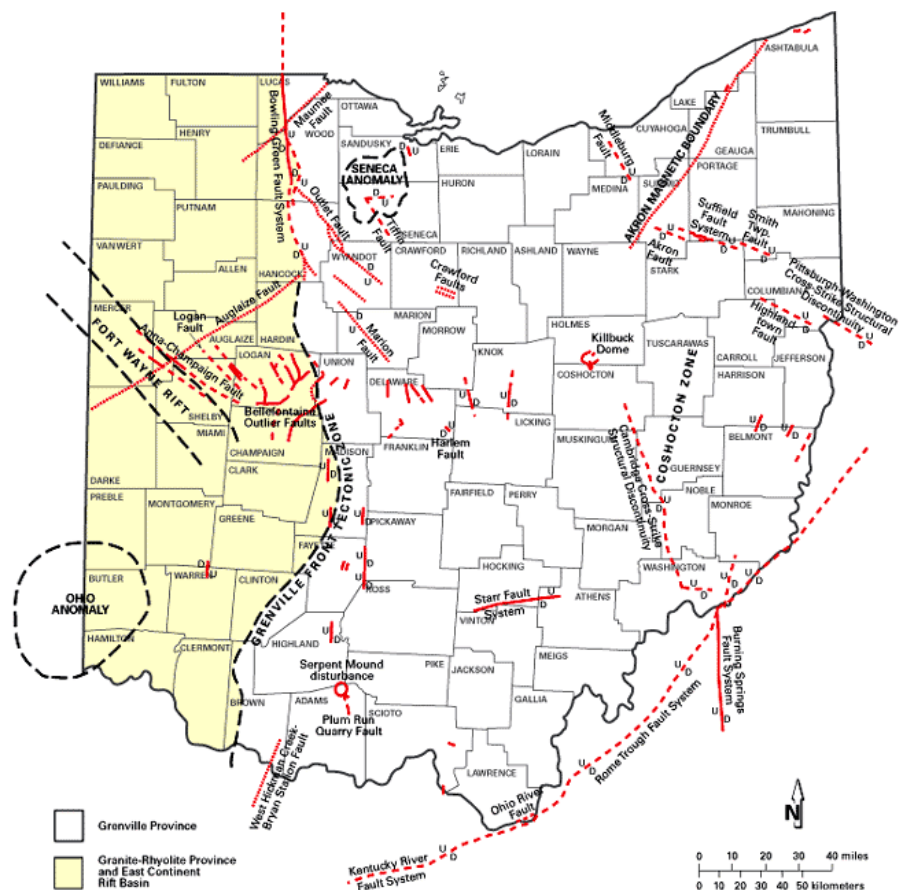


Figure 26. Earthquake Fault System in Ohio

¹ The lithosphere of the earth is divided into a small number of plates that float on and travel independently over the mantle. Much of the earth's seismic activity occurs at the boundaries of these plates, known as tectonic zones.

4.7.1. Monitoring of Earthquakes

The Ohio Department of Natural Resources (ODNR) Division of Geological Survey has established a 22 station cooperative network of seismograph stations throughout the State in order to continuously record earthquake activity. The network, which went on line in January 1999, ended a five-year gap during which there was only one operating station in Ohio. The state was dependent on seismographs in Kentucky and Michigan to record Ohio earthquakes. The 22 stations of the new seismograph network, which is called OhioSeis, are distributed across the state, but are concentrated in the most seismically active areas or in areas that provide optimal conditions for detecting and locating very small earthquakes that are below the threshold of human notice. These small micro earthquakes are important because they occur more frequently and help to identify the location of faults that may periodically produce larger, potentially damaging earthquakes.

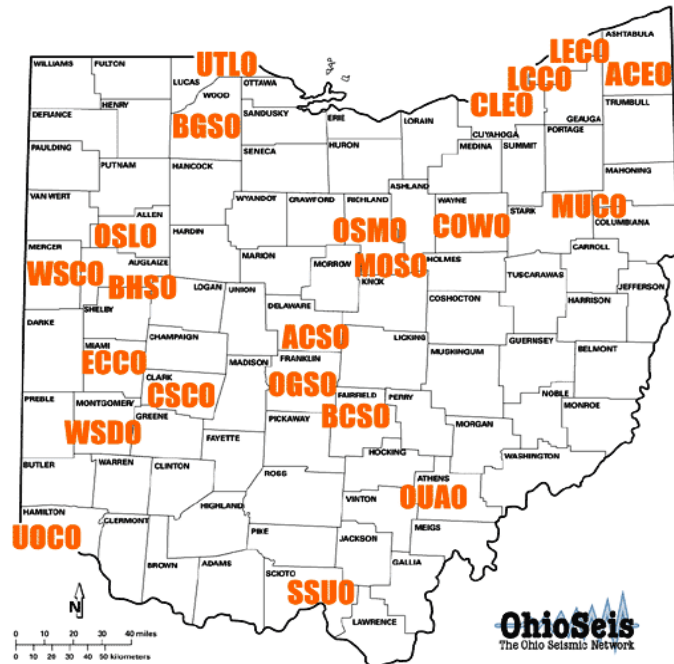


Figure 27. OhioSeis Locations in Ohio

The OhioSeis seismograph stations are located at colleges, universities and other institutions, employing new technology that not only makes them very accurate, but also relatively inexpensive and easy to operate and maintain. In contrast to the old technology, in which a pen made a squiggly line on a paper drum, the new system is entirely digital and uses a Macintosh desktop computer to continuously record and display data. Two other innovations have made the system unique. An inexpensive Global Positioning System (GPS) receiver is used to keep very precise time on the continuously recorded seismogram, and each station's computer is connected to the Internet for rapid data transfer.

The closest monitoring stations to Clermont County are located at the University of Cincinnati and at Wright State University near Dayton. These locations are:

Station OGSO

Location:

University of Cincinnati
Department of Geology
500 Geology/Physics Building
Cincinnati, OH 45221-0013

Lat: 39.140° North
Long: 84.522° West
Elev: 226 m

Contact Person:

Dr. Attila Kilinc
attila.kilinc@uc.edu

Station ACSO

Location:

Wright State University
Department of Geological Sciences
Brehm Lab
Dayton, OH 45435

Lat: 39.783° North
Long: 84.063° West
Elev: 289 m

Contact Person:

Dr. Ernest C. Hauser
Ernest.hauser@wright.edu

4.7.2. Monroe Township (Clermont County) Risk Zone

According to Candice Sherry, Ohio Earthquake Program Manager, Clermont County is in a high-risk zone in relation to the proximity of the New Madrid Fault Line. The geological make-up of the area, glacial till, is considered to be unconsolidated material and increases the earthquake risk. These deposits tend to be unstable when exposed to vibrations that occur during earthquakes.

4.7.3. Monroe Township (Clermont County) Historical Earthquake Events

According to the Ohio Department of Natural Resources, Geological Survey, an earthquake of a magnitude greater than 2.0 has not occurred in Clermont County since 1864. The only three earthquakes on record for Clermont County occurred in the 1800's: a 2.9 magnitude event in 1804, a 2.5 magnitude event in 1859, and a 2.5 magnitude event in 1864. The epicenters associated with these three events can be seen Figure 28.

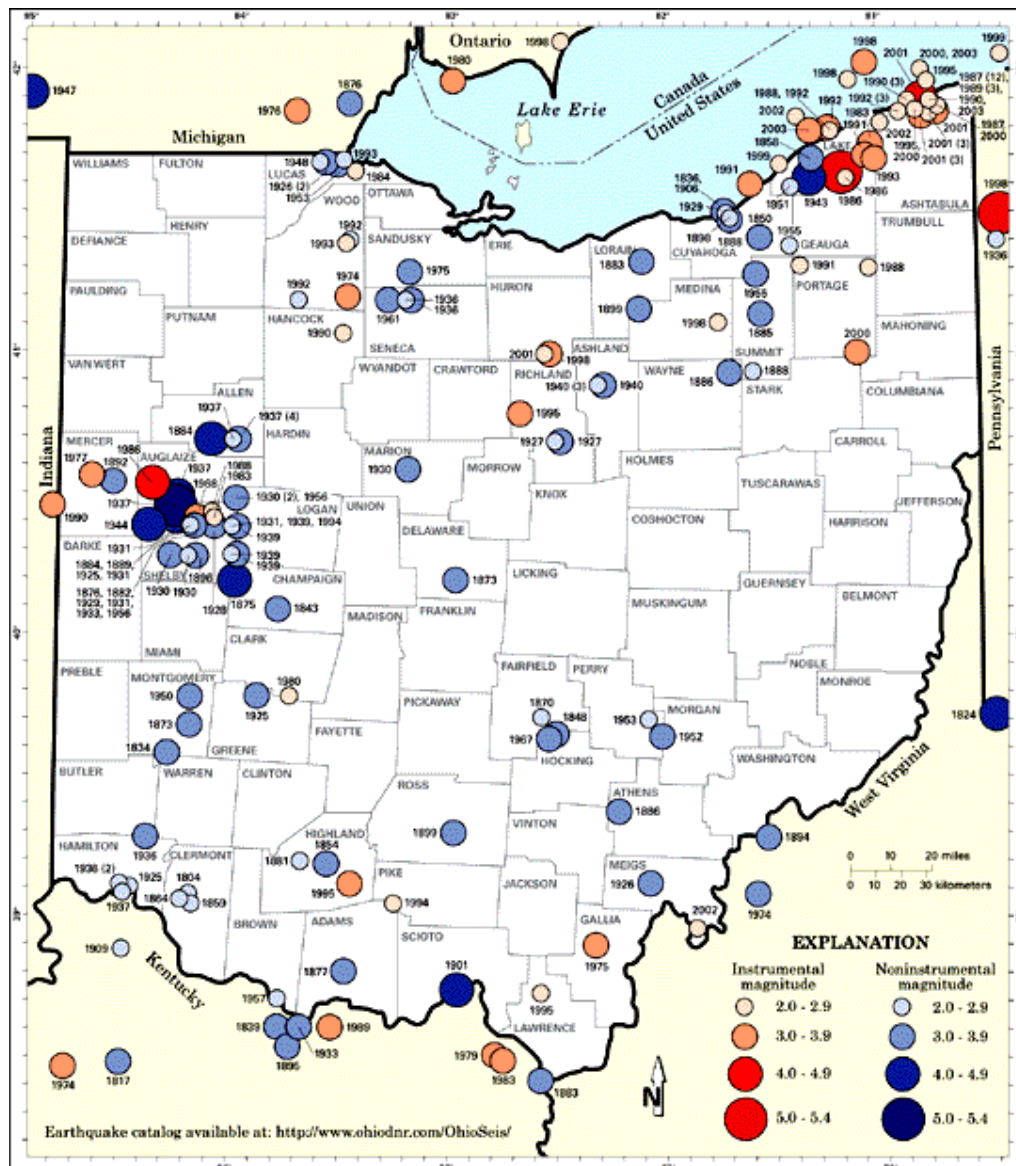


Figure 28. Earthquake Epicenters in Ohio

4.7.4. Infrastructure and Critical Facilities

Earthquakes are a non site-specific hazard and as such, the impacts on infrastructure and critical facilities are difficult to discern. In terms of both infrastructure and critical facilities, the effects of an earthquake can be significantly damaging and cover a broad geographical area. Road networks can be disrupted and if buildings have not been built to withstand certain loadings, structural damage will result. Additional efforts and analyses will be undertaken as to the effects of earthquakes on infrastructure and critical facilities for future plan updates.

4.7.5. Monroe Township Earthquake Mitigation Efforts

There are no earthquake mitigation efforts currently underway, nor have there have any occurred in the recent past.

4.7.6. Current Development Trends

Since earthquakes are a non site-specific hazard, current development trends have no effect other than the increased population that would be susceptible to earthquakes within the Township's boundaries. These are some Ohio communities that have started to look into building codes tailored to addressing earthquakes through standards for loads, etc.

4.7.7. Hazard Assessment and Vulnerability Assessment / Potential Dollars Lost

According to the Ohio Department of Natural Resources, Division of Geological Survey, there are no records of an earthquake greater than a magnitude of 2.0 in Clermont County from the late 1800's to the present. No significant damage has been noted in recorded history for Monroe Township. The recurrence interval for major earthquakes for Monroe Township is upwards of 100 years. It is not anticipated that Monroe Township will encounter an earthquake in the next 100 years, but there is a possibility of damage should a tectonic zone become active. Since the occurrence of an earthquake is quite rare in Clermont County, the Core Group felt that their best approach to analyzing the vulnerability to an earthquake might be by looking at other states and communities and how they have dealt with earthquake preparedness. Due to the historically rare occurrence of this hazard in Monroe Township, no potential dollars lost calculations have been considered at this time.

4.7.8. Matrix Results

Monroe Township		Total
Earthquakes		
No action.		0
There is a lack of education on the effects of earthquakes.		
Increase education through programs in schools and through public access.		21
There is a need to inventory high risk structures and identify high risk soil areas.		
Undertake an inventory of high risk structures and high risk soil areas.		20
There is a lack of earthquake response materials.		
Develop earthquake response materials for the township administrator.		20

Figure 29. Matrix Results for Earthquakes

The matrix results show the overall rating for the Core Group's collective group effort to fill out the matrix. The highest rated activity from the matrix evaluation is highlighted in the matrix above in pink.

- ***Increase education through programs in schools and through public access.***

5. Highest Rated Activities and Action Plan

5.1 Highest Rated Activities

For the six hazards identified by the Core Group as being the most important natural hazards in Monroe Township, 34 problem statements were developed with 59 associated action items considered. Prior to undertaking the actions/projects listed below, the action/project will be analyzed using FEMA's cost-benefit module, where appropriate. The following are the highest rated activities based on the matrix ratings.

Severe Storms

- Inventory and identify high water/flooding problem locations.
- Use GIS to identify and map the existing shelters and create an inventory of such shelters.
- Implement a Township research program that will identify the need for an early warning system.
- Seek funding to purchase weather radios for all citizens.

Flooding

- Update NFIP maps.
- Focus on preventative maintenance practices in regards to debris removal.
- Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.
- Notify the County/State of their responsibility in regards to debris removal.
- Investigate property acquisition programs for the repetitive loss property and the at-risk structures located along the southern boundary of the Township.

Erosion/Landslides

- The Township should aggressively pursue the development of a land use plan that will address both existing and new development.
- Develop an inventory of erosion/landslide sites.
- Develop an inventory of structures on hillsides.

Tornadoes

- Use GIS to identify and map the existing shelters and create an inventory of such shelters.

- Seek a block grant for the construction of new shelters.
- Focus on preventative maintenance practices in regards to debris removal.
- Identify/inventory problem areas that are responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.
- Notify the County/State of their responsibility in regards to debris removal.
- Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.
- Develop plans/ideas for seeking funding for adding/maintaining additional sirens. This will involve the use of new technology and research into the need for an early warning system.

Drought

- Increase enforcement of the mowing code.
- Examine the mowing code for the possibility of increasing the mowing frequency.
- Issue a public service announcement in the Township newsletter.
- Increase education through the development of a drought procedure manual.
- Earthquakes
- Increase education through programs in schools and through public access.

5.1. Action Items Schedule

An Action Plan for Monroe Township was compiled with the items listed above. The Action Plan provides a timeline estimate of when each item will be undertaken, an estimated cost for each item, as well as a responsible individual/department who will implement the item. The Action Plan will be utilized by Township officials and staff to act as a starting point in assessing and implementing activities on a yearly basis. Prior to undertaking the projects shown on Figure 30, the project will be analyzed using FEMA's cost-benefits module where appropriate.

Model Implementation Schedule			
	Implementation Schedule (Year)	Funding / Project Estimate	Responsible Entity
Severe Storms			
High water/flood warning signs are needed at problem locations.			
Inventory and identify problem locations.	2007	Internal resources - no additional cost	Township Maintenance / Clermont County Engineer's Office / Public Safety
There is a need to identify existing public shelters.			
Use GIS to identify and map the existing shelters and create an inventory of such shelters.	2006	Internal resources - no additional cost	Township Maintenance / Clermont County GIS Department
Additional warning sirens are needed.			
Implement a township research program that will identify the need for an early warning system.	2008	Internal resources - no additional cost	Township Maintenance / Office of Technology, Communications, Security
All citizens need weather radios.			
Seek funding to purchase weather radios for all citizens.	2008	Internal resources - no additional cost	Township Maintenance / EMA
Flooding			
NFIP maps are outdated and must be updated.			
Update NFIP maps.	2006	\$40,000	Clermont County GIS Department / FEMA
There is a need to improve debris removal.			
Focus on preventative maintenance practices.	2005-2009	Internal resources - no additional cost	Township Maintenance / SWCD
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.	2008	Internal resources - no additional cost	Township Maintenance / SWCD
Notify the County/State of their responsibility.	2005-2009	Internal resources - no additional cost	Township Maintenance
There are existing structures in the floodplain.			
Investigate property acquisition programs for the repetitive loss property and the at-risk structures located along the southern boundary of the Township.	2008	\$5,000	Township Maintenance / EMA
Erosion/Landslides			
Development regulations and enforcement on sloped property needs to be improved.			
The Township should aggressively pursue the development of a land use plan that will address both existing and new development. (Process is already underway)	2007	Internal resources - no additional resources	Township Maintenance / Zoning Administrator / Clermont County Planning
There is a lack of knowledge of erosion/landslide sites.			
Develop an inventory of erosion/landslide sites.	2007	Internal resources - no additional cost	Township Maintenance / Clermont County Engineer / SWCD
There is inadequate design and construction of structures on hillsides.			
Develop an inventory of erosion/landslide sites.	2008	Internal resources - no additional cost	Township Maintenance / Clermont County Planning & GIS Departments
Tornadoes			
There is a need to identify more public shelters/supplies.			
Use GIS to identify and map the existing shelters and create an inventory of such shelters.	2006	Internal resources - no additional cost	Clermont County GIS Department / Township Maintenance
Seek a block grant for the construction of new shelters.	2009	Internal resources - no additional cost	Township Maintenance
There is a need to improve debris removal.			
Focus on preventative maintenance practices.	2005-2009	Internal resources - no additional cost	Township Maintenance / SWCD
Identify/inventory problem areas responsible for chronic debris problems and clear those areas first. Partner with the Ohio Department of Health/FEMA.	2008	Internal resources - no additional cost	Township Maintenance / SWCD
Notify the County/State of their responsibility.	2005-2009	Internal resources - no additional cost	Township Maintenance
There is a need to identify response agencies and an associated need to improve response coordination with "mutual aid."			
Ensure that the Township checks annually to make certain that the response agency list and mutual aid provider list is up-to-date.	2005-2009	Internal resources - no additional cost	Township Maintenance / EMA
The tornado warning system needs improvement.			
Develop plans/ideas for seeking funding for adding/maintaining additional sirens. This will involve the use of new technology and research into the need for an early warning system.	2008	\$25,000	Township Maintenance / Office of Technology, Communications, Security
Drought			
There is a lack of enforcement of fire source materials (i.e. mowing) during dry periods.			
Increase enforcement of the mowing code.	2008	Internal resources - no additional cost	Zoning Administrator / SWCD
Examine the mowing code for the possibility of increasing the mowing frequency.	2008	Internal resources - no additional cost	Zoning Administrator / SWCD
Issue a public service announcement in the township newsletter.	2007	\$1200 quarterly publication and mailing cost	Township Maintenance
There is a lack of education to reduce damage to building foundations and other structures.			
Increase education through the development of a drought procedure manual.	2009	\$2,500	OSU Extension Office / SWCD
Earthquakes			
There is a lack of education on the effects of earthquakes.			
Increase education through programs in schools and through public access.	2009	\$2,500	OSU Extension Office / Office of Public Information / SWCD

*Note: Prior to undertaking projects/actions above, the project/action will be analyzed with the FEMA cost-benefit module where appropriate.

Figure 30. Action Plan

6. Plan Maintenance

The Core Group will meet annually for the purpose of monitoring and evaluating the Monroe Township Hazard Mitigation Plan. The meeting will be held so that it coincides with the budget season so that funding can be set aside for actions slated in that particular year. This meeting will be publicized to the public. Every five years, major plan updates will be sent to the Ohio Emergency Management Agency (OEMA) to ensure that the newly updated items still meet the required Hazard Mitigation Plan standards. The Core Group will make the necessary changes and updates to the plan before submitting it to OEMA.

A copy of the plan will reside in each Township department. Each department will be responsible for keeping track of which items they are accountable for implementing. At the annual meeting, the parties responsible for various implementation actions will report on the status of their projects. This will allow for the revision of mitigation strategies if deemed necessary. Activities that have been completed will be noted as such within the plan and new activities will be added when necessary.

The Core Group will review the goals and action items to determine their relevance to changing situations in the township and in Clermont County, to ensure that current and expected conditions are addressed. The Core Group will also review the risk assessment portion of the Hazard Mitigation Plan to determine if this information should be updated or modified, given any new available data.

The public will be involved in the monitoring and updating process as well. Local businesses and non-profit organizations as well as any representatives from academia, will be encouraged to participate in the monitoring and updating process as well. In addition to holding an annual open meeting for the purpose of monitoring and evaluating the Hazard Mitigation Plan, Monroe Township will post information regarding updates to the plan through community newspapers and mailings and if possible, on the Township's web site. These updates will include the mitigation items that are currently being undertaken.

The Monroe Township Hazard Mitigation Plan will be incorporated into other existing planning documents, including township zoning regulations where appropriate, and activities such as capital improvements. The Monroe Township Hazard Mitigation Plan will also be incorporated into the comprehensive planning effort underway in the Township and once the comprehensive plan is finalized, the Hazard Mitigation Plan will be used in conjunction with that document. The Hazard Mitigation Plan will take into account any changes in the comprehensive land use plan as time progresses, and will incorporate the information accordingly in the plan updates. Each of the Township departments will refer to the Hazard Mitigation Plan wherever feasible within the existing documents that support mitigation and growth within the Township.

Appendix A

Copy of Resolution of Adoption



Birthplace of our
18th President
Ulysses S. Grant

Monroe Township

Clermont County
2828 St. Rt. 222 • Bethel, Ohio 45106
513-734-6462

First Reading: May 10, 2005
Second Reading and Action to Adopt: June 14, 2005

RESOLUTION NO. 05-61 RESOLUTION ADOPTING THE CLERMONT COUNTY NATURAL HAZARD MITIGATION PLAN

WHEREAS, at Resolution 05-61, the Board of Trustees authorized in part the following grant agreement:

WHEREAS, the Federal Emergency Management Agency (FEMA) has established rules and regulations under 44 CFR Parts 201.6, which requires that

“For disasters declared after November 1, 2004, a local government must have a mitigation plan approved pursuant to this section in order to receive HMGP project grants.”; and

WHEREAS, The Monroe Township Trustees have received a grant from FEMA to prepare such a mitigation plan entitled the “Natural Hazard Mitigation Plan – Monroe Township, Ohio” (HMP); and a copy of the draft HMP has been placed on the Monroe Township EMA website at www.monroetwp.org and

WHEREAS, in addition, it is understood that:

“For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan;” and

WHEREAS, the FEMA regulation 201.6 requires:

“Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted; and

WHEREAS, the Board of the Monroe Township Trustees have reviewed the draft “Monroe Township Natural Hazard Mitigation Plan”; and

NOW THEREFORE BE IT RESOLVED THAT THE Monroe Township Board of Trustees does hereby adopt the “Natural Hazard Mitigation Plan for Monroe Township, and

BE IT FUTHER RESOLVED THAT THE Board of Monroe Township Trustees prepare and submit to the Federal Emergency Management Agency in accordance with the draft rules and regulations published by FEMA, the Monroe Township Hazard Mitigation Plan; and

BE IT FURTHER RESOLVED THAT THE Clerk of the Township be and hereby is authorized and directed to certify copies of this resolution to the Ohio EMA and FEMA.

ADOPTED at a meeting of the Monroe Township Board of Trustees, on this 14th day of June, 2005.

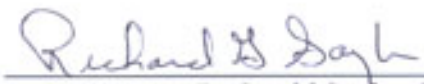
Trustees Kunz introduced the foregoing Resolution and moved its adoption. Trustee Saylor seconded the Motion. The roll being called upon the question of adoption of the Resolution by the Township Clerk, the vote resulted as follows:

Mrs. Richardson: Yeah Mr. Kunz: Yeah Mr. Saylor: Yeah

Adopted at the meeting of the Board of Trustees the 14th day of June, 2005.


Joyce Richardson, Chairperson


David Kunz, Co-Chairperson


R. Gerald Saylor, Trustee

This is to certify that this resolution was duly adopted by the Board of Trustees, and filed with the Monroe Township Clerk, this 14th day of June, 2005.


Thea Kellum
Monroe Township Clerk

Appendix B

Public Meeting Notices

Page 6 - The Clermont Sun - Thursday, October 30, 2003

There will be a public meeting of Monroe Township hazardous mitigation committee on at 6 p.m. Thursday, Nov. 6. The meeting will be held at the Monroe Township hall, located at 2828 state Route 222. Public input is welcomed at this meeting. For more information call 734-6462.

Page 8 - The Clermont Sun - Thursday, January 8, 2004

PUBLIC NOTICE

There will be a public meeting of the Monroe Township Hazardous Mitigation Committee on Thursday, January 15th at 6:00 p.m. The meeting will be held at the Monroe Township Hall, 2828 St. Rt. 222. Public input is welcomed at this meeting. If you have any questions please call 734-6462.

Tom Wildey, Director of Services
Monroe Township
CS 1-8t1

Appendix C

Copy of Letter to Adjacent
Communities, Businesses
and Local Education
Board, and List of
Recipients



Home of our
18th president

Monroe Township

Clermont County
2828 St Rt. 222 Bethel, Ohio 45106
513-734-6460

Trustees
Joyce Ann Richardson
David Kunz
Richard G. Saylor

Clerk
Thea Kellum

Dear:

Monroe Township is moving forward in making the community disaster resistant and encouraging you to be a part of this process. The Federal Disaster Mitigation Act of 2000 requires that local communities develop Hazard Mitigation Plans (HMPs) with specific goals for mitigating natural disasters such as flooding, severe storms, and tornadoes. These plans are required in order to qualify for pre-or post-disaster mitigation funding under the Federal Disaster Mitigation Act.

A Core Group has been established primarily for the purpose of assisting in the creation of the Monroe Township Hazard Mitigation Plan. The Core Group members are considered as the "leaders" of this effort and will have a key role in creating a Mitigation Plan that the Township can adopt.

The planning process is already underway. The Core Group has selected and prioritized a list of hazards affecting Monroe Township that will be assessed in the plan. The next steps of the planning process are to compile the plan and once it is completed, the public will have an opportunity to review the plan and provide comments.

You are encouraged to participate in the planning efforts. Notifications will be sent out for any future meetings and you are encouraged to attend those to provide your insights and feedback. Any questions that you may have regarding the planning process or requests for additional information should be directed to Tom Wildey, Director of Services at (513) 734-6462

Sincerely,

Tom Wildey
Director of Services, Monroe Township

List of Recipients:

Batavia Township Trustees
2410 Old St. Rt. 32
Batavia, Ohio 54103

Franklin Township Trustees
981 Hopewell Road
Felicity, Ohio 45120

Ohio Township Trustees
2897 Mt. Pisgah Road
New Richmond, Ohio 45157

Pierce Township Trustees
950 Locust Corner Road
Cincinnati, Ohio 45245

Tate Township Trustees
316 South Charity Street
Bethel, Ohio 45106

Washington Township Trustees
2238 St. Rt. 756
Moscow, Ohio 45153

New Richmond Exempted Village School District
Mr. Charles Moore, Superintendent
212 Market St.
New Richmond, Ohio 45157

Clermont County Chamber of Commerce
553 Chamber Drive
Milford, Ohio 45150

Appendix D

Meeting Summaries

HAZARD MITIGATION MEETING – Monroe Township Jan. 15, 2004

In attendance: Jim Latchaw, Denny Jowers, Ray Sebastian, Tom Wildey, Dani Spiegel, Nancy Jolley

Dani turned over the Committee to Tom Wildey, the new Administrator and the rest of the Committee brought Tom up-to-date.

We discussed the need to make statements concise and meaningful and to think globally (i.e., tornadoes – increase warning sirens, build shelters). We discussed the need to prioritize and the need for specific examples. We can then come back and add or delete.

PROBLEM STATEMENTS

1. Severe Storms

- Additional warning sirens
- Enhanced siren maintenance program
- Education program for “private” subdivisions (maintaining access)
- Power outages (education and/or preparation)
- Lack of an adequate stormwater drainage system
- Off-site/downstream drainage issues resulting from development (residential, type)
- Inadequate infrastructure sizing requirements for developments
- Need more weather radios for all citizens
- High water/flood warning signs at problem locations
- Post-storm damage assessments need to be improved
- Encourage/improve coordination and communication with County, et.al

2. Floods

- Inadequate infrastructure
- Identify high-risk flash flooding areas
- Improve warning system for high-risk areas
- Educate residents and leadership in flood prone areas about flood issues and post flood procedures
- Education and reinforcement of hazardous materials in floodplain areas (100-year)
- Identify potential utility hazards
- Update NFIP maps
- Uniform flood depth data
- Improve debris removal

3. Erosion (landslides)

- Improve development regulations on sloped property
- Inadequate design/construction of structure on hillsides
- Stop-gap (band aid repairs on road slippage/landslide problems)

4. Tornadoes (The committee, by majority vote, voted to move tornadoes to #4 and drought to #5. Motion made by Ray Sebastian and seconded by Tom Wildey.)

- Improve warning system (i.e. sirens)
- Improve public education
- Improve debris removal
- Identify more public shelters/supplies
- Identify response agencies
- Improve response coordination with “mutual aid”
- Improve weather spotter training

5. Droughts

- Enforcement of fire source materials (i.e. mowing) during dry periods
- Education to reduce damage to foundation and other structures
- Develop drought procedure manual
- Dust problems from construction areas

6. Earthquakes

- Improve education
 - Schools
 - Public access
- Inventory high risk structures
- Identify high risk structures
- Identify high risk soil areas
- Develop township administrator response materials

HAZARD MITIGATION MEETING – Monroe Township February 12, 2004

(Next meeting Thursday, March 11, 2004 6:00pm)

In Attendance: Jim Latchaw, Dennis Jowers(734-6462), Ray Sebastian (732-7213), Tom Wildey (734-6462), Nancy Jolley (527-8379), Tom Marck (553-3033)

SOLUTIONS

1. Severe Storms

Potential actions:

- Additional warning sirens
 - A. Township research program on the need for early warning system (Beth – for avenues available)
 - B. Partner with other entities to obtain warning sirens (contact County and other Townships)
 - C. Develop maintenance program
- Education program for “private” subdivisions (maintaining access)
 - A. Research subdivisions – develop ordinance for all properties in subdivisions to be under (for fire protection) and require a homeowner association regardless of size
 - B. EMT to place door hangers for fire , floods, tornadoes and snow emergency preparedness brochure (include brochure in newsletter)
 - C. Develop relationship with State Board of Health that mobile homes meet the same access requirements as other private residences
- Power outages (education and/or preparation)
 - A. Determine what needs to be available in terms of health aids (i.e., nebulizers, generators for breathing machines)
 - B. Determine what preparation is needed – create lists of the individual homes affected and a list of volunteers
 - C. Public information system
 - D. Identify shelters and critical facilities (critical facilities include Monroe School and Head Start building)
 - E. Generator backup for emergency services
 - F. Tornado and fire drills performed at critical facilities

- Lack of an adequate storm water drainage system
 - A. Township has active participation in the County water regulation program (development and regulation enforcement)
 - B. Storm spotting
 - C. Change design criteria
 - D. Weather radios for all citizens – additional grant money to buy radios and for Red Cross to obtain CO₂ detectors and fire detectors
 - E. High water/flood warning signs at problem locations
 - F. Inventory and identify locations
 - G. Water depth signs in dips/swales (partner with County/State)
- Post-storm damage assessments need to be improved.
 - A. Post-storm communication (County/State/IMAC/BOA) recovery, federal declaration.
 - B. Partner with County EMA and participate in additional training in County-wide 911 building initiatives and Department of Homeland Defense.

2. Floods

- Inadequate infrastructure
 - A. Check drainage facilities, culverts, size of stream for pipes
 - B. Develop/Coordinate programs to meet or exceed County programs
- Have maintenance identify high-risk flash flooding areas and notify residents they are in high risk area.
 - A. Use County GIS system map/data/pictures.
 - B. Improve warning system for high-risk areas (see high water/flood).
 - C. Educate residents and leadership in flood prone areas about flood issues and post flood procedures.
 - D. Education and reinforcement of hazardous materials in flood plain areas (100-year floodplains).
 - E. Identify /inventory potential utility hazards (ground transformers, gas meters, propane tanks floatability, fuel oil tanks in basements, water tank abandonment, tower abandonment, inventory storage buildings – in flood areas for proper anchoring of tanks. Conduct hazard material training. Add inspection program.

F. Update NFIP maps (National Flood Insurance Program) and floodway study by the Army Corps of Engineers

- Big Indian flood study mapping will be completed soon. County finished study.

- There is a need for uniform flood depth data.

A. Uniform/NWS – Point Pleasant depth gauge similar to New Richmond's

- Improve debris removal

A. Preventative maintenance should be the focus not post-event maintenance

B. Identify/inventory problem areas responsible for chronic debris problems. Clear those areas first (coordination with Ohio Department of Health/FEMA).

C. Notify County/State of their responsibility.

3. Erosion (landslides)

- Improve development regulations on sloped property
- Inadequate design/construction of structures on hillsides
- Stop-gap (band aid) repairs on road slippage/landslide problems

4. Tornadoes (The Committee voted by majority to move tornado to #4 and Drought to #5 (Motion made by Ray Sebastian and seconded by Tom Wildey).

- Improve warning system (i.e. sirens)
- Improve public education
- Improve debris removal
- Identify more public shelters/supplies
- Identify response agencies
- Improve response coordination with "mutual aid"
- Improve weather spotter training

5. Droughts

- Enforcement of fire source materials (i.e. mowing) during dry periods
- Education to reduce damage to foundation and other structures
- Develop drought procedure manual

- Dust problems from construction sites

6. Earthquakes

- Improve education through schools and public access
- Inventory high risk structures
- Identify high risk soil areas
- Develop township administrator response materials

HAZARD MITIGATION MEETING – Monroe Township April 22, 2004

In Attendance: Jim Latchaw (860-1070), Dennis Jowers(734-6462), Tom Wildey (734-6462), Nancy Jolley (527-8379), Mary Werner (732-7286), Ed Wildey

ADDITIONAL SOLUTIONS

1. Erosion (landslides)

- Improve development and enforcement of regulations on sloped property
 - A. Township must be pro-active when preparing new land use plan.
 - B. Land use plan should address both old and new development.
 - C. Township should aggressively pursue development of land use plan.
 - D. There is a lack of knowledge of erosion/landslide sites.
 - Develop an inventory of erosion/landslide sites.
- There is Inadequate design/construction of structures on hillsides
 - A. There is a lack of knowledge of structures on hillsides.
 - Develop an inventory of structures on hillsides.
- Stop-gap (band aid) repairs on road slippage/landslide problems

2. Tornadoes

- Develop plan/ideas for seeking funding for adding/maintaining more sirens.
 - A. Seek use of new technology
 - B. Township research program/need for early warning system (Beth-for avenues available)
 - C. Develop siren maintenance program
- Public education program for “private” subdivisions (maintaining access)
 - A. Develop an ordinance for all properties in subdivisions to be under (tornado protection) and require homeowner association regardless of size
 - B. EMT to place door hangers for tornado emergency preparedness brochure (include brochure in newsletter) (fire, flood, tornado)
 - C. Develop relationship with State Board of Health that mobile homes meet access requirements as other private residences.
- Power outages (education and/or preparation)

- A. Determine what needs to be available in terms of health aides (i.e., nebulizers, generators for breathing machines)
- B. Determine what preparation is needed – create lists of the individual homes affected and a list of volunteers
- C. Public information system
- D. Identify shelters and critical facilities (critical facilities include Monroe School and Head Start building)
- E. Generator backup for emergency services
- F. Tornado and fire drills performed at critical facilities
- Lack of adequate storm water drainage system
 - A. Township active participation in County water regulation program (development and regulation enforcement)
 - B. Storm spotting
 - C. Change design criteria
 - D. Weather radios for all citizens – additional grant money to buy radios and for Red Cross to obtain CO₂ detectors and fire detectors
 - E. High water/flood warning signs at problem locations
 - Inventory and identify locations
 - Water depth signs in dips/swale (partner with County/State)
- Post-storm damage assessments need to be improved.
 - A. Post-storm communication (County/State/IMAC/BOA) recovery, federal declaration
 - B. Partner with County EMA and participate in additional training in County-wide 911 building initiatives and Department of Homeland Defense
 - Research availability of existing Public Education program that township could adopt.
- Township public education programs as necessary (schools)
- Township efforts should focus on areas in high population density
 - A. Develop a response plan
 - B. Develop “supply” list

- Identify existing public shelters (Map – GIS) and list inventory
- Train shelter operators
- Seek block grant to build new shelters
 - A. Township checks annually to ensure response agency list and mutual aid provider is up to date
 - B. Identify weather spotter candidates/volunteers
 - Have volunteers attend the weather spotter's school
- Improve debris removal
- 3. Droughts
 - Lack of enforcement of fire source materials (i.e. mowing) during dry periods
 - A. Enforce mowing code
 - Examine code for possibility of increasing mowing frequency
 - B. Public service announcement in township newsletter
 - Lack of education to reduce damage to foundation and other structures
 - Develop drought procedure manual
 - Enforcement of dust problems from construction sites (coordinate with County to make sure regulations are being followed)
- 4. Earthquakes
 - Educate by developing Public Service Announcements
 - A. Brochures
 - B. Television VHS tape
 - Improve education
 - A. Schools
 - B. Public access
 - Inventory high risk structures
 - Identify high risk soil areas
 - Develop township administrator response materials

HAZARD MITIGATION MEETING – Monroe Township December 6, 2004

In attendance: Richard Saylor, Tom Marck, Dennis Jowers, Dani Speigel, Tom Wildey, Jim Rozelle and Katie Dixon

The purpose of this meeting was to provide updates on the planning process, to set overall goals for each hazard, and to obtain the required items necessary for plan completion.

Updates were provided on the planning process, outlining the next steps to be taken which include the matrix evaluation and compilation of historical hazard data for each of the six hazards. Case-specific documentation is needed for site-specific hazards like erosion and landslides. Damages associated with past hazard occurrences and associated costs are also needed. The Core Group was informed of the need to identify systemic flooding locations within the Township. The Core Group agreed to identify such locations on a map along with critical facilities for use in the hazard assessment piece of the plan. The Core Group was also asked for information on current development trends including pinpointing the locations of developing areas.

The importance of public notification was stressed at the meeting. Katie stated that adjacent communities must be notified of the planning effort underway in the Township and she committed to providing example letters to serve as a template. Public involvement and notification is critical with respect to the review of the plan once a draft is issued.

In terms of overall goals, the overall goals were developed utilizing examples of other communities' goals. The goals as developed by the Core Group are as follows:

- Severe Storms: To address preparedness and to increase awareness of severe storms, with special emphasis on the Township's early warning system, in a manner that saves lives and reduces property damages incurred by severe storms.
- Flooding: To save lives and property, reduce flood damage, and increase educational awareness of flooding in Monroe Township in a way that compliments existing efforts.
- Erosion/Landslides: To increase awareness of hillside and streambank erosion and erosion associated with development, as well as to learn about and implement different techniques that can be used to control erosion and landslides.
- Tornadoes: To save lives, property and resources by planning for and increasing awareness of the dangers of tornado events, placing special emphasis on the Township's early warning system.
- Drought: To reduce the potential damage associated with droughts as well as wildfires to increase awareness.
- Earthquakes: To reduce the potential damage of earthquakes and to increase awareness.

Appendix E

Severe Storm Events (County-Wide)

***SNOW & ICE event(s) were reported in Clermont County, Ohio
between 01/01/1950 and 06/30/2004.***

Location	Date	Type	Deaths	Injuries	Property Damage
1 Athens, Butler, Clermont, Clinton, Hamilton, Hocking, Preble, Ross, Warren, Washington	12/25/1993	Heavy Snow	0	0	5K
2 Ashland, Ashtabula, Butler, Champaign, Clark, Clermont, Clinton, Crawford, Darke, Delaware, Franklin, Geauga, Greene, Hamilton, Highland, Huron, Knox, Lake, Licking, Lorain, Madison, Medina, Miami, Montgomery, Morrow, Portage, Preble, Richland, Summit, Warren, Wayne	03/09/1994	Heavy Snow	0	0	500K
3 Brown, Butler, Champaign, Clark, Clermont, Fayette, Greene, Hamilton, Miami, Montgomery, Preble, Warren	01/06/1995	Ice Storm	0	26	400K
4 Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Fairfield, Fayette, Franklin, Greene, Hamilton, Hocking, Lucas, Mercer, Miami, Montgomery, Ottawa, Paulding, Pickaway, Preble, Putnam, Ross, Shelby, Van Wert, Warren, Williams	01/21/1995	Snow	2	6	500K
5 Athens, Brown, Butler, Clermont, Clinton, Gallia, Hamilton, Highland, Jackson, Meigs, Pike, Ross, Vinton, Warren, Washington	01/28/1995	Heavy Snow/ice	0	0	600K
6 Brown, Butler, Clermont, Clinton, Coshocton, Fairfield, Fayette, Hamilton, Harrison, Highland, Hocking, Knox, Licking, Monroe, Muskingum, Perry, Pickaway, Ross, Warren	02/03/1995	Heavy Snow	0	0	60K

7 Adams, Brown, Clermont, Clinton, Gallia, Highland, Hocking, Pike, Ross, Warren	03/01/1995	Heavy Snow	0	0	50K
8 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Highland, Hocking, Licking, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Warren	01/06/1996	Winter Storm	2	0	14.3M
9 Adams, Auglaize, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Greene, Hamilton, Highland, Licking, Madison, Mercer, Miami, Montgomery, Pickaway, Preble, Ross, Scioto, Union, Van Wert, Warren	01/11/1996	Heavy Snow	0	0	26K
10 Adams, Allen, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Paulding, Pickaway, Pike, Preble, Putnam, Ross, Scioto, Shelby, Union, Van Wert, Warren	03/06/1996	Ice Storm	0	0	0
11 Adams, Allen, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Paulding, Pickaway, Pike, Preble,	03/19/1996	Winter Storm	1	0	0

Putnam, Ross, Scioto, Shelby, Union, Van Wert, Warren					
12 Butler, Champaign, Clark, Clermont, Clinton, Darke, Fairfield, Fayette, Franklin, Greene, Hamilton, Licking, Madison, Miami, Montgomery, Pickaway, Preble, Warren	01/24/1997	Ice Storm	0	0	0
13 Adams, Brown, Clermont, Hamilton, Highland, Pike, Ross	01/27/1997	Ice Storm	0	0	0
14 Adams, Brown, Butler, Clermont, Clinton, Fayette, Hamilton, Highland, Pike, Ross, Scioto, Warren	02/03/1998	Winter Storm	0	0	0
15 Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Preble, Ross, Shelby, Union, Warren	01/01/1999	Winter Storm	0	0	0
16 Auglaize, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Preble, Ross, Shelby, Union, Warren	01/07/1999	Winter Storm	0	0	0
17 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway,	03/09/1999	Heavy Snow	0	0	0

Pike, Preble, Ross, Scioto, Shelby, Union, Warren					
18 Adams, Brown, Clermont, Hamilton, Highland, Hocking, Pike, Ross, Scioto	03/13/1999	Heavy Snow	0	0	0
19 Adams, Brown, Butler, Champaign, Clark, Clermont, Clinton, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Highland, Hocking, Licking, Madison, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Union, Warren	12/13/2000	Ice Storm	0	0	0
20 Adams, Brown, Clermont, Highland, Pike, Ross, Scioto	01/19/2001	Heavy Snow	0	0	0
21 Adams, Brown, Butler, Clermont, Clinton, Hamilton, Highland, Hocking, Pike, Ross, Scioto, Warren	12/05/2002	Winter Storm	0	0	0
22 Butler, Clermont, Pike, Scioto	01/16/2003	Winter Storm	0	0	0
23 Adams, Brown, Butler, Clermont, Clinton, Hamilton, Highland, Pike, Ross, Scioto, Warren	02/16/2003	Winter Storm	0	0	1.5M
24 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Preble, Ross, Shelby, Union, Warren	01/25/2004	Winter Storm	0	0	0

**THUNDERSTORM & HIGH WIND event(s) were reported in Clermont County, Ohio
between 01/01/1950 and 09/30/2004.**

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
1 Clermont	11/26/1965	Tstm Wind	55 kts.	0	0	0	0
2 Clermont	07/13/1966	Tstm Wind	0 kts.	0	0	0	0
3 Clermont	05/18/1969	Tstm Wind	0 kts.	0	0	0	0
4 Clermont	04/01/1974	Tstm Wind	0 kts.	0	0	0	0
5 Clermont	07/15/1976	Tstm Wind	0 kts.	0	0	0	0
6 Clermont	10/01/1977	Tstm Wind	0 kts.	0	0	0	0
7 Clermont	05/12/1980	Tstm Wind	57 kts.	0	0	0	0
8 Clermont	06/02/1980	Tstm Wind	52 kts.	0	0	0	0
9 Clermont	05/02/1983	Tstm Wind	0 kts.	0	0	0	0
10 Clermont	07/18/1983	Tstm Wind	0 kts.	0	0	0	0
11 Clermont	07/23/1983	Tstm Wind	0 kts.	0	0	0	0
12 Clermont	06/11/1985	Tstm Wind	0 kts.	0	0	0	0
13 Clermont	05/07/1986	Tstm Wind	0 kts.	0	0	0	0
14 Clermont	08/06/1986	Tstm Wind	0 kts.	0	0	0	0
15 Clermont	07/26/1987	Tstm Wind	0 kts.	0	0	0	0
16 Clermont	04/23/1988	Tstm Wind	0 kts.	0	0	0	0
17 Clermont	08/05/1988	Tstm Wind	0 kts.	0	0	0	0
18 Clermont	04/29/1989	Tstm Wind	0 kts.	0	0	0	0
19 Clermont	07/12/1989	Tstm Wind	0 kts.	0	0	0	0
20 Clermont	07/27/1989	Tstm Wind	0 kts.	0	0	0	0
21 Clermont	07/27/1989	Tstm Wind	0 kts.	0	0	0	0
22 Clermont	08/05/1989	Tstm Wind	0 kts.	0	0	0	0
23 Clermont	06/06/1990	Tstm Wind	0 kts.	0	0	0	0
24 Clermont	07/05/1990	Tstm Wind	0 kts.	0	0	0	0
25 Clermont	07/09/1990	Tstm Wind	0 kts.	0	0	0	0
26 Clermont	07/11/1990	Tstm Wind	0 kts.	0	0	0	0
27 Clermont	07/20/1990	Tstm Wind	0 kts.	0	0	0	0
28 Clermont	08/22/1990	Tstm Wind	0 kts.	0	0	0	0
29 Clermont	08/28/1990	Tstm Wind	0 kts.	0	0	0	0
30 Clermont	09/14/1990	Tstm Wind	0 kts.	0	0	0	0
31 Clermont	04/09/1991	Tstm Wind	0 kts.	0	0	0	0
32 Clermont	04/23/1991	Tstm Wind	0 kts.	0	0	0	0
33 Clermont	05/16/1991	Tstm Wind	0 kts.	0	0	0	0
34 Clermont	05/16/1991	Tstm Wind	0 kts.	0	0	0	0
35 Clermont	05/17/1991	Tstm Wind	0 kts.	0	0	0	0
36 Clermont	07/02/1991	Tstm Wind	0 kts.	0	0	0	0
37 Clermont	08/03/1991	Tstm Wind	0 kts.	0	0	0	0
38 Clermont	08/08/1991	Tstm Wind	0 kts.	0	0	0	0
39 Clermont	04/10/1992	Tstm Wind	0 kts.	0	0	0	0
40 Clermont	06/18/1992	Tstm Wind	0 kts.	0	0	0	0
41 Clermont	06/18/1992	Tstm Wind	0 kts.	0	0	0	0
42 Clermont	07/09/1992	Tstm Wind	0 kts.	0	0	0	0
43 Clermont	07/11/1992	Tstm Wind	0 kts.	0	0	0	0
44 Clermont	07/18/1992	Tstm Wind	0 kts.	0	0	0	0
45 Clermont	09/21/1992	Tstm Wind	0 kts.	0	0	0	0
46 Pierce	08/28/1993	Thunderstorm	N/A	0	0	50K	0

		Winds					
47 Southern Half	03/18/1994	High Winds	0 kts.	0	2	500K	0
48 Countywide	04/15/1994	Thunderstorm Winds	N/A	0	0	500K	0
49 Williamsburg	06/07/1994	Thunderstorm Winds	N/A	0	0	50K	0
50 Stonelick Township	06/16/1994	Thunderstorm Winds	N/A	0	0	5K	0
51 Clermontville	06/17/1994	Thunderstorm Winds	N/A	0	0	5K	0
52 Jackson Township	06/21/1994	Thunderstorm Winds	N/A	0	0	5K	0
53 Loveland	08/04/1994	Thunderstorm Winds	N/A	0	0	5K	0
54 Batavia And	05/29/1995	Thunderstorm Winds	N/A	0	0	7K	0
55 Southwest	10/20/1995	High Winds	0 kts.	0	0	3K	0
56 New Richmond	04/20/1996	Tstm Wind	50 kts.	0	0	2K	0
57 Manchester	04/23/1996	Tstm Wind	50 kts.	0	0	1K	0
58 Batavia	04/29/1996	Tstm Wind	50 kts.	0	0	2K	0
59 Batavia	05/04/1996	Tstm Wind	50 kts.	0	0	3K	0
60 Felicity	05/04/1996	Tstm Wind	50 kts.	0	0	2K	0
61 Neville	05/08/1996	Tstm Wind	50 kts.	0	0	10K	0
62 Bethel	05/24/1996	Tstm Wind	50 kts.	0	0	3K	0
63 Amelia	06/14/1996	Tstm Wind	50 kts.	0	0	5K	0
64 Batavia	06/24/1996	Tstm Wind	50 kts.	0	0	3K	0
65 Countywide	11/07/1996	Tstm Wind	50 kts.	0	0	10K	0
66 Goshen	01/05/1997	Tstm Wind	50 kts.	0	0	5K	0
67 Batavia	03/28/1997	Tstm Wind	52 kts.	0	0	0	0
68 Bethel	05/19/1997	Tstm Wind	60 kts.	0	0	100K	0
69 Clermontville	07/22/1997	Tstm Wind	50 kts.	0	0	5K	0
70 Countywide	07/27/1997	Tstm Wind	50 kts.	0	0	10K	0
71 Countywide	08/17/1997	Tstm Wind	50 kts.	0	0	15K	0
72 Lindale	08/27/1997	Tstm Wind	50 kts.	0	0	5K	0
73 Loveland	05/13/1998	Tstm Wind	50 kts.	0	0	5K	0
74 Batavia	05/19/1998	Tstm Wind	50 kts.	0	0	3K	0
75 Laurel	06/10/1998	Tstm Wind	50 kts.	0	0	3K	0
76 Moscow	06/10/1998	Tstm Wind	50 kts.	0	0	3K	0
77 Owensville	06/11/1998	Tstm Wind	50 kts.	0	0	3K	0
78 Countywide	06/12/1998	Tstm Wind	50 kts.	0	0	10K	0
79 Milford	06/16/1998	Tstm Wind	50 kts.	0	0	3K	0
80 Goshen	06/19/1998	Tstm Wind	50 kts.	0	0	10K	0
81 Batavia	06/22/1998	Tstm Wind	50 kts.	0	0	5K	0
82 Milford	06/29/1998	Tstm Wind	50 kts.	0	0	3K	0
83 Countywide	07/19/1998	Tstm Wind	60 kts.	0	0	20K	0
84 Batavia	11/10/1998	Tstm Wind	50 kts.	0	0	3K	0
85 Countywide	04/09/1999	Tstm Wind	50 kts.	0	0	10K	0
86 Amelia	05/06/1999	Tstm Wind	50 kts.	0	0	3K	0
87 Countywide	06/10/1999	Tstm Wind	57 kts.	0	0	500K	0
88 Amelia	06/11/1999	Tstm Wind	50 kts.	0	0	16K	0
89 Goshen	06/13/1999	Tstm Wind	52 kts.	0	0	6K	0

90 Goshen	07/09/1999	Tstm Wind	50 kts.	0	0	3K	0
91 Loveland	04/20/2000	Tstm Wind	50 kts.	0	0	5K	0
92 Bethel	04/20/2000	Tstm Wind	50 kts.	0	0	5K	0
93 Perintown	06/02/2000	Tstm Wind	52 kts.	0	0	4K	0
94 Monterey	06/02/2000	Tstm Wind	55 kts.	0	0	15K	0
95 Owensville	06/26/2000	Tstm Wind	52 kts.	0	0	3K	0
96 New Richmond	08/17/2000	Tstm Wind	50 kts.	0	0	5K	0
97 Miamiville	09/20/2000	Tstm Wind	50 kts.	0	0	5K	0
98 Batavia	09/20/2000	Tstm Wind	50 kts.	0	0	5K	0
99 Amelia	09/23/2000	Tstm Wind	50 kts.	0	0	10K	0
100 Countywide	11/09/2000	Tstm Wind	50 kts.	0	0	100K	0
101 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Shelby, Union, Warren	12/11/2000	High Wind	58 kts.	1	0	100K	0
102 Pt Pleasant	04/06/2001	Tstm Wind	50 kts.	0	0	3K	0
103 Countywide	06/12/2001	Tstm Wind	55 kts.	0	0	5K	0
104 Mt Pisgah	07/08/2001	Tstm Wind	50 kts.	0	0	5K	0
105 Miamiville	07/08/2001	Tstm Wind	50 kts.	0	0	3K	0
106 Felicity	07/08/2001	Tstm Wind	50 kts.	0	0	10K	0
107 Milford	07/17/2001	Tstm Wind	50 kts.	0	0	3K	0
108 Batavia	07/17/2001	Tstm Wind	50 kts.	0	0	3K	0
109 Batavia	07/17/2001	Tstm Wind	50 kts.	0	0	50K	0
110 Countywide	08/11/2001	Tstm Wind	50 kts.	0	0	0	0
111 Countywide	10/24/2001	Tstm Wind	50 kts.	0	0	5K	0
112 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking,	03/09/2002	High Wind	73 kts.	1	12	971K	0

Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Shelby, Union, Warren							
113 Clermont, Hamilton	04/28/2002	High Wind	50 kts.	0	0	40K	0
114 Saltair	05/07/2002	Tstm Wind	50 kts.	0	0	25K	0
115 Amelia	07/29/2002	Tstm Wind	51 kts.	0	0	3K	0
116 Milford	08/11/2002	Tstm Wind	50 kts.	0	0	5K	0
117 Countywide	07/04/2003	Tstm Wind	50 kts.	0	0	7K	0
118 New Richmond	07/09/2003	Tstm Wind	50 kts.	0	0	3K	0
119 Milford	07/09/2003	Tstm Wind	50 kts.	0	0	2K	0
120 Loveland	07/15/2003	Tstm Wind	50 kts.	0	0	3K	0
121 Batavia	07/15/2003	Tstm Wind	50 kts.	0	0	3K	0
122 Loveland	07/21/2003	Tstm Wind	50 kts.	0	0	2K	0
123 Williamsburg	05/27/2004	Tstm Wind	50 kts.	0	0	3K	0
124 Felicity	05/30/2004	Tstm Wind	50 kts.	0	0	2K	0
125 Countywide	05/30/2004	Tstm Wind	50 kts.	0	0	8K	0
126 Countywide	07/09/2004	Tstm Wind	50 kts.	0	0	5K	0
127 Batavia	07/10/2004	Tstm Wind	50 kts.	0	0	3K	0
128 Williamsburg	07/10/2004	Tstm Wind	50 kts.	0	0	3K	0

***LIGHTNING event(s) were reported in Clermont County, Ohio
between 01/01/1950 and 09/30/2004.***

Location	Date	Deaths	Injuries	Property Damage	Crop Damage
1 Milford	05/15/1996	0	0	5K	0
2 Owensville	05/16/1996	0	0	5K	0
3 Union Twp	05/24/1996	0	0	50K	0
4 Milford	06/06/1996	0	0	1K	0
5 Central Portion	06/10/1999	0	2	0	0
6 Milford	08/18/2002	0	3	0	0

Appendix F

Flood Events (County-Wide)

FLOOD event(s) were reported in Clermont County, Ohio between 01/01/1950 and 06/30/2004.

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
1 Clermont	08/16/1993	Flash Flood	N/A	0	1	500K	0
2 Countywide	04/10/1994	Flash Flood	N/A	0	0	500K	0
3 Countywide	05/18/1995	Flash Flood	N/A	0	0	7	0
4 Milford	05/18/1995	Flood	N/A	0	0	2K	0
5 Countywide	05/24/1995	Flash Flood	N/A	0	0	6K	0
6 Clermont	05/24/1995	Flash Flood	N/A	0	0	5K	0
7 Countywide	05/28/1995	Flash Flood	N/A	0	0	4K	0
8 Clermont	05/29/1995	Flash Flood	N/A	0	0	7K	0
9 North And West Parts	06/01/1995	Flash Flood	N/A	0	0	5K	0
10 North Half	06/17/1995	Flash Flood	N/A	0	0	7K	0
11 Countywide	08/09/1995	Flash Flood	N/A	0	0	5K	0
12 Adams, Auglaize, Brown, Butler, Clermont, Delaware, Franklin, Hamilton, Highland, Mercer, Montgomery, Pickaway, Pike, Ross, Scioto, Van Wert	01/17/1996	Flood	N/A	0	0	187K	0
13 Adams, Brown, Clermont, Hamilton, Highland, Pickaway, Pike, Ross, Scioto	01/23/1996	Flood	N/A	0	0	5.1M	0
14 Clermont, Hamilton, Warren	04/29/1996	Flood	N/A	0	0	11K	0
15 Edenton	04/29/1996	Flash Flood	N/A	0	0	2K	0
16 Countywide	05/04/1996	Flash Flood	N/A	0	0	10K	0
17 Clermont, Hamilton, Warren	05/11/1996	Flood	N/A	0	0	0	0
18 Clermont, Hamilton	05/15/1996	Flood	N/A	0	0	0	0
19 Countywide	05/15/1996	Flash Flood	N/A	0	0	5K	0
20 Franklin Twp	07/29/1996	Flash Flood	N/A	0	0	25K	0

21 Countywide	12/01/1996	Flash Flood	N/A	0	0	0	0
22 Felicity	03/01/1997	Flash Flood	N/A	0	0	10K	0
23 Adams, Brown, Clermont, Hamilton, Scioto	03/02/1997	Flood	N/A	0	0	15.0M	0
24 Countywide	03/02/1997	Flash Flood	N/A	0	0	10K	0
25 Adams, Clark, Clermont, Franklin, Hamilton, Pickaway, Pike, Putnam, Ross, Warren	06/01/1997	Flood	N/A	0	0	1.0M	0
26 Countywide	06/01/1997	Flood	N/A	0	0	10K	0
27 Batavia	06/16/1997	Flood	N/A	0	0	10K	0
28 Countywide	06/18/1997	Flood	N/A	0	0	5K	0
29 Countywide	04/16/1998	Flood	N/A	0	0	0	0
30 Clermont, Warren	04/16/1998	Flood	N/A	0	0	0	0
31 Felicity	06/10/1998	Flash Flood	N/A	0	0	100K	0
32 Countywide	06/11/1998	Flood	N/A	0	0	5K	0
33 Batavia	06/16/1998	Flood	N/A	0	0	0	0
34 Countywide	01/03/2000	Flood	N/A	0	0	50K	0
35 Clermont, Hamilton	01/04/2000	Flood	N/A	0	0	0	0
36 Clermont, Hamilton	02/14/2000	Flood	N/A	0	0	0	0
37 Countywide	02/18/2000	Flood	N/A	0	0	10K	0
38 Clermont, Hamilton, Warren	02/18/2000	Flood	N/A	0	0	0	0
39 Clermont, Hamilton	02/18/2000	Flood	N/A	0	0	0	0
40 Clermont	02/21/2000	Flood	N/A	0	0	0	0
41 Bethel	07/04/2000	Flood	N/A	0	0	5K	0
42 Countywide	08/09/2000	Flood	N/A	0	0	5K	0
43 Countywide	12/16/2000	Flood	N/A	0	0	5K	0
44 Northwest Portion	05/18/2001	Flood	N/A	0	0	5K	0
45 Goshen	06/06/2001	Flood	N/A	0	0	3K	0
46 Countywide	07/17/2001	Flash Flood	N/A	0	0	1.8M	0
47 Clermont	07/18/2001	Flood	N/A	0	0	0	0
48 Williamsburg	07/25/2001	Flood	N/A	0	0	0	0
49 Felicity	07/26/2001	Flood	N/A	0	0	0	0
50 Countywide	08/11/2001	Flood	N/A	0	0	0	0
51 Batavia	08/18/2001	Flood	N/A	0	0	0	0
52 Brown, Clermont, Logan	04/19/2002	Flood	N/A	0	0	0	0
53 Adams, Clermont, Hamilton, Pike, Ross	04/21/2002	Flood	N/A	0	0	0	0
54 Adams, Brown, Clermont, Highland, Pike	04/28/2002	Flood	N/A	0	0	0	0

55 South Central Portion	05/07/2002	Flash Flood	N/A	0	0	3K	0
56 South Portion	05/08/2002	Flash Flood	N/A	0	0	0	0
57 Clermont, Franklin, Hamilton, Licking	05/28/2002	Flood	N/A	0	0	0	0
58 Adams, Clermont, Clinton, Hamilton, Licking, Scioto	06/06/2002	Flood	N/A	0	0	0	0
59 Butler, Champaign, Clark, Clermont, Clinton, Franklin, Greene, Hamilton, Miami, Montgomery, Preble, Warren	11/10/2002	Flood	N/A	0	0	0	0
60 Adams, Clermont, Pike, Scioto	02/22/2003	Flood	N/A	0	0	0	0
61 Adams, Brown, Butler, Clark, Clermont, Clermont, Clinton, Hamilton, Hamilton, Highland, Montgomery, Ross, Scioto, Warren	05/10/2003	Flood	N/A	0	0	0	0
62 Owensville	05/10/2003	Flash Flood	N/A	0	0	100K	0
63 Adams, Brown, Clermont, Montgomery, Pike, Warren, Warren	07/10/2003	Flood	N/A	0	0	150K	0
64 Clermont	07/13/2003	Flood	N/A	0	0	0	0
65 Adams, Clermont, Hamilton, Pickaway, Warren	07/15/2003	Flood	N/A	0	0	0	0
66 Milford	08/02/2003	Flash Flood	N/A	0	0	0	0
67 Clermont, Hamilton, Pike	08/08/2003	Flood	N/A	0	0	0	0

Appendix G

Statewide Drought Events

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
1 Lake	06/21/1994	N/A	0	0	0	0
2 Northern Ohio	09/01/1995	N/A	0	0	0	0
3 Ashland, Ashtabula, Crawford, Cuyahoga, Erie, Fulton, Geauga, Hancock, Henry, Holmes, Huron, Knox, Lake, Lorain, Lucas, Mahoning, Marion, Medina, Morrow, Ottawa, Portage, Richland, Sandusky, Seneca, Stark, Summit, Trumbull, Wayne, Wood, Wyandot	08/01/1996	N/A	0	0	0	0
4 Ashtabula, Lorain, Mahoning, Stark, Trumbull	07/01/1997	N/A	0	0	0	0
5 Gallia, Jackson, Lawrence, Meigs, Vinton	05/01/1999	N/A	0	0	0	0
6 Ashland, Ashtabula, Crawford, Cuyahoga, Erie, Fulton, Geauga, Hancock, Henry, Holmes, Huron, Knox, Lake, Lorain, Lucas, Mahoning, Marion, Medina, Morrow, Ottawa, Portage, Richland, Sandusky, Seneca, Stark, Summit, Trumbull, Wayne, Wood, Wyandot	06/01/1999	N/A	0	0	0	0
7 Athens, Gallia, Jackson, Lawrence, Meigs, Vinton, Washington	06/01/1999	N/A	0	0	0	0
8 Ashland, Ashtabula, Crawford, Cuyahoga, Erie, Fulton, Geauga, Hancock, Henry, Holmes, Huron, Knox, Lake, Lorain, Lucas, Mahoning, Marion, Medina, Morrow, Ottawa, Portage, Richland, Sandusky, Seneca, Stark, Summit, Trumbull, Wayne, Wood, Wyandot	07/01/1999	N/A	0	0	0	0
9 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Shelby, Union, Warren	07/01/1999	N/A	0	0	0	0

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
10 Athens, Gallia, Jackson, Lawrence, Meigs, Morgan, Perry, Washington	07/01/1999	N/A	0	0	0	0
11 Ashland, Ashtabula, Crawford, Cuyahoga, Erie, Fulton, Geauga, Hancock, Henry, Holmes, Huron, Knox, Lake, Lorain, Lucas, Mahoning, Marion, Medina, Morrow, Ottawa, Portage, Richland, Sandusky, Seneca, Stark, Summit, Trumbull, Wayne, Wood, Wyandot	08/01/1999	N/A	0	0	0	0
12 Adams, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Delaware, Fairfield, Fayette, Franklin, Greene, Hamilton, Hardin, Highland, Hocking, Licking, Logan, Madison, Mercer, Miami, Montgomery, Pickaway, Pike, Preble, Ross, Scioto, Shelby, Union, Warren	08/01/1999	N/A	0	0	0	0
13 Belmont, Carroll, Columbiana, Coshocton, Guernsey, Harrison, Jefferson, Monroe, Muskingum, Noble, Tuscarawas	08/01/1999	N/A	0	0	0	0
14 Athens, Gallia, Jackson, Lawrence, Meigs, Morgan, Perry, Vinton, Washington	08/01/1999	N/A	0	0	0	0
15 Ashland, Ashtabula, Crawford, Cuyahoga, Erie, Geauga, Hancock, Holmes, Huron, Knox, Lake, Lorain, Lucas, Mahoning, Marion, Medina, Morrow, Ottawa, Portage, Richland, Sandusky, Seneca, Stark, Summit, Trumbull, Wayne, Wood, Wyandot	09/01/1999	N/A	0	0	0	200.0M
16 Belmont, Carroll, Columbiana, Coshocton, Guernsey, Harrison, Jefferson, Monroe, Muskingum, Noble, Tuscarawas	09/01/1999	N/A	0	0	0	0
17 Athens, Gallia, Jackson, Lawrence, Meigs, Morgan, Perry, Vinton, Washington	09/01/1999	N/A	0	0	0	0

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
18 Athens, Gallia, Jackson, Lawrence, Meigs, Morgan, Perry, Vinton, Washington	10/01/1999	N/A	0	0	0	0
19 Athens, Gallia, Jackson, Lawrence, Meigs, Morgan, Perry, Vinton, Washington	09/01/2002	N/A	0	0	0	0